

APPENDIX Y
FINAL TECHNICAL SUPPORT DOCUMENT (1991)

R&D Manufacturing, Inc.

Colfax, Louisiana

**Final Technical Support
Document for the R&D
Thermal Treatment System**

ENSR Consulting and Engineering

April 1991

Document Number 3246-001-630(284)

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1.0 INTRODUCTION

ENSR Consulting and Engineering has been retained by R&D Fabricating and Manufacturing, Inc. located in Colfax, Louisiana to conduct a source characterization program for an open explosives thermal treatment system. Information contained in Figure 1-1 reveals the location of the R&D facility, the plant fenceline and the location of the treatment sites. The present document includes the results from the emissions testing program, the estimate of pollutant emission rates, an air dispersion modeling study to estimate off-site pollutant concentrations and a health risk assessment. ENSR conducted the source testing program according to the procedures discussed in the report "Final Source Characterization Plan for the R&D Thermal Treatment System, September 1990", ENSR Document No. 3246-001-200, and approved by EPA Region VI in a letter to Mr. Richard Crain dated December 11, 1990. The air dispersion modeling study and health risk assessment discussed in the present report was conducted according to the procedures discussed in the report "Final Health Risk Assessment Protocol for the R&D Thermal Treatment System, August 1990", ENSR Document No. 3246-001-500 and approved, with minor modifications, by EPA Region VI in a letter to Mr. Richard Crain dated December 11, 1990. Please refer to the above documents when reviewing the present report.

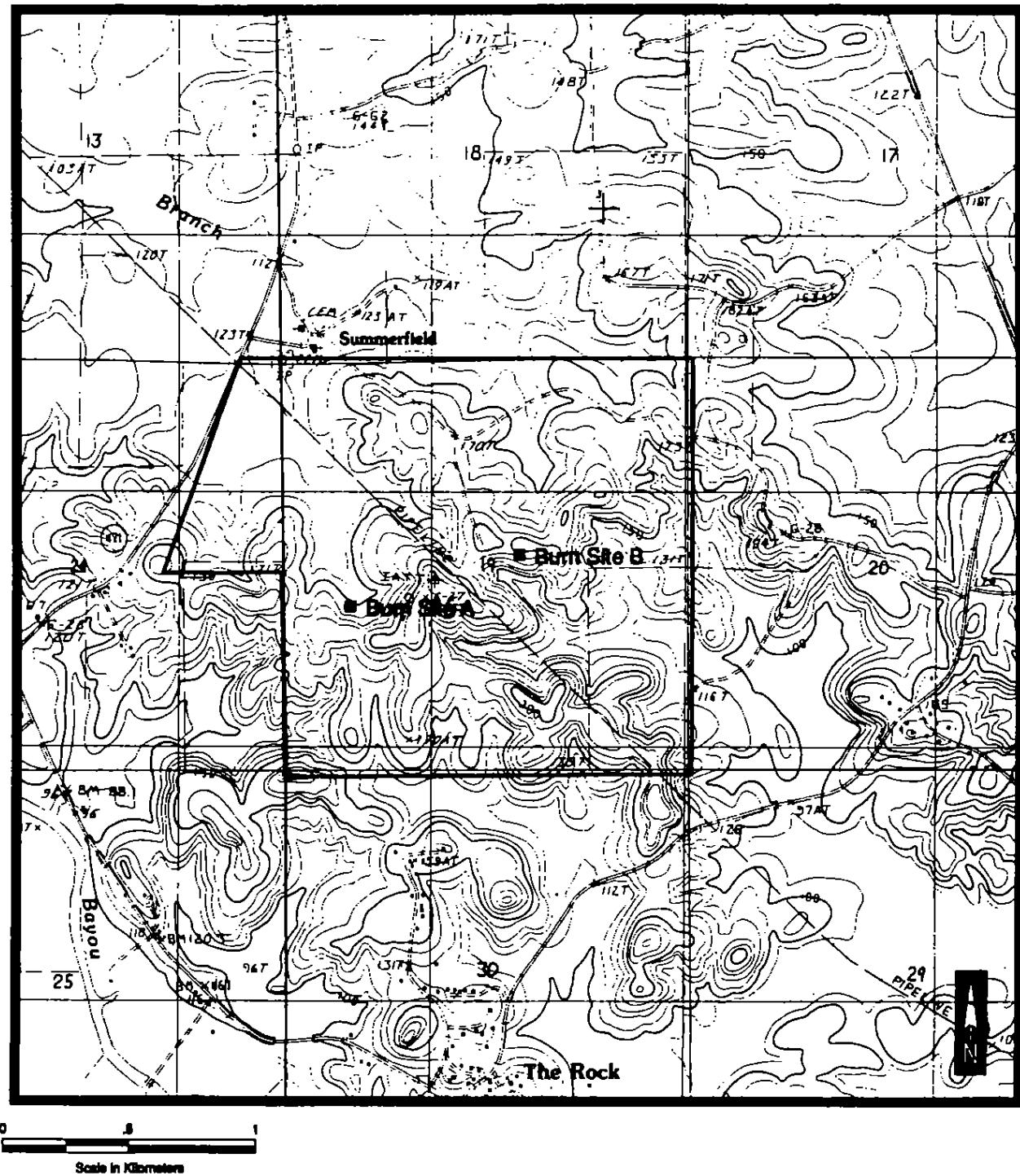


FIGURE 1-1
The Location of The R&D Facility

2.0 SOURCE CHARACTERIZATION STUDY

2.1 Overview

ENSR conducted the source characterization program at the R&D facility Burn Site A during the period from January 3 through January 16, 1991. All testing parameters were described in ENSR Document 3246-001-200. Briefly, three monitoring sites and a 10 meter meteorological tower were established at the thermal treatment facility. Two of the monitoring sites were used for downwind sampling locations and one served as the upwind, or control site. Sampling took place during periods without precipitation, with persistent winds generally between 5 and 10 mph. The configuration of the samplers relative to the thermal treatment sites varied by sampling run during the execution of the study as result of shifting wind direction. Three waste categories were treated during the source testing program. Specific waste streams that were treated included RDX, TNT and lead azide detonators. The following parameters were included in the sampling program:

- Particulates,
- Trace metals including, aluminum (Al), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), antimony (Sb), selenium (Se) and zinc (Zn),
- Polycyclic aromatic hydrocarbons including, benzo(a)pyrene (BaP), benzo(e)pyrene (BeP), benzo(k)fluoranthene (BkF), benzo(j)fluoranthene (BjF), benzo(b)fluoranthene (BbF), indeno(c,d)pyrene (IcdP), dibenzo(a,h)anthracene (DbahA), coronene (Cor), and 1-nitropyrene (1NPY),
- RDX (for RDX treatment only),
- DNT and TNT (for TNT treatment only),
- Phenol,
- Volatile organic compounds including, benzene, toluene, ethylbenzene and total xylenes.

Each sampling site included five (5) samplers plus field co-located samplers for quality assurance purposes. The procedures used to collect each pollutant, the analytical methods used to quantify pollutant concentrations and the concentrations of each pollutant are summarized below and discussed in greater detail in ENSR Document No. 3246-001-200.

2.1.1 Particulates and Trace Metals

High volume samplers equipped with glass fiber filters were utilized to collect particulates and trace metals as per 40 CFR Part 50, Appendix B and ENSR SOP's 6000-201, 2620-001 and 2620-002. Filter weights were determined gravimetrically per 40 CFR Part 50, Appendix B. Selected trace elements were extracted from a 10" x 8" filter with HNO₃ acid. Depending on the trace element of interest, extracts were analyzed via graphite furnace atomic absorption spectrometry (AAS) or inductively-coupled plasma (ICAP) instruments. All procedures followed those discussed in EPA SW-846 Method 7000.

2.1.2 Polycyclic Aromatic Hydrocarbons (PAHs)

High volume samplers equipped with glass fiber filters were utilized to collect PAHs, as per 40 CFR Part 50, Appendix B and ENSR SOP's 6000-201, 2620-001 and 2620-002. Selected PAH, and 1-nitropyrene were Soxhlet extracted from a 10" x 8" filter utilizing HPLC grade dichloromethane as per EPA SW-846 Method 3540. The resulting extracts were analyzed via high resolution GC/low resolution MS as per EPA SW-846 Method 8270. The MS was operated in the selective ion mode (SIM) to increase the sensitivity of the analytical method.

2.1.3 RDX

High volume samplers equipped with glass fiber filters were utilized to collect RDX, as per 40 CFR Part 50, Appendix B and ENSR SOP's 6000-201, 2620-001 and 2620-002. RDX was extracted via sonication from a 10" x 8" filter utilizing HPLC grade acetonitrile. RDX were analyzed by reversed-phase HPLC using a Zorbax ODS column or equivalent (i.e., Supelco LC 18 column) and UV detection at 254 nm according to the USATHAMA certified method LW21.

2.1.4 DNT and TNT

General Metal Works PS-1 samplers were utilized to collect DNT and TNT, per ENSR SOP 2622-021. The collection media of glass fiber filters followed by XAD-2 packed glass cartridges were prepared according to ENSR SOP 2622-020. DNT and TNT were extracted from the 10 cm diameter glass fiber filter and XAD-2 resin via sonication utilizing HPLC grade dichloromethane. Analysis was via capillary column GC and low resolution MS according to SW-846 Method 8270.

2.1.5 Volatile Organic Compounds (VOCs)

All samples were collected utilizing paired VOST tubes; the first cartridge consists of approximately 2 g of Tenax-GC, with a backup cartridge consisting of 1 g Tenax-GC and 1 g activated charcoal. The VOC sampling procedures followed ENSR SOP 2622-022. All samples were thermally-desorbed at approximately 220°C. Prior to analysis each pair of cartridges was spiked with known amounts of bromofluorobenzene. VOST cartridge analysis followed EPA Method T-01.

2.2 Description of Conditions During Waste Treatment

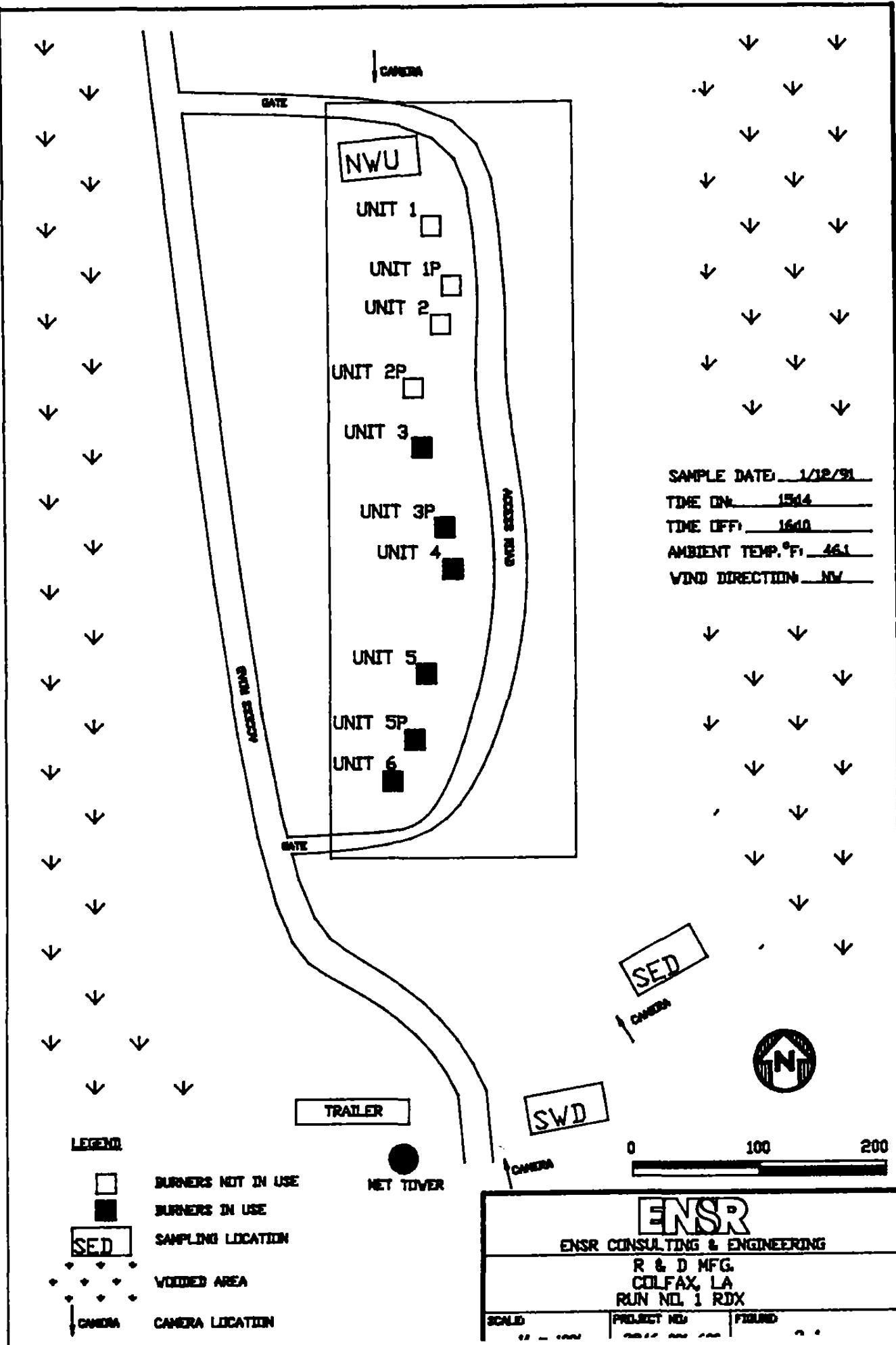
2.2.1 RDX Treatment

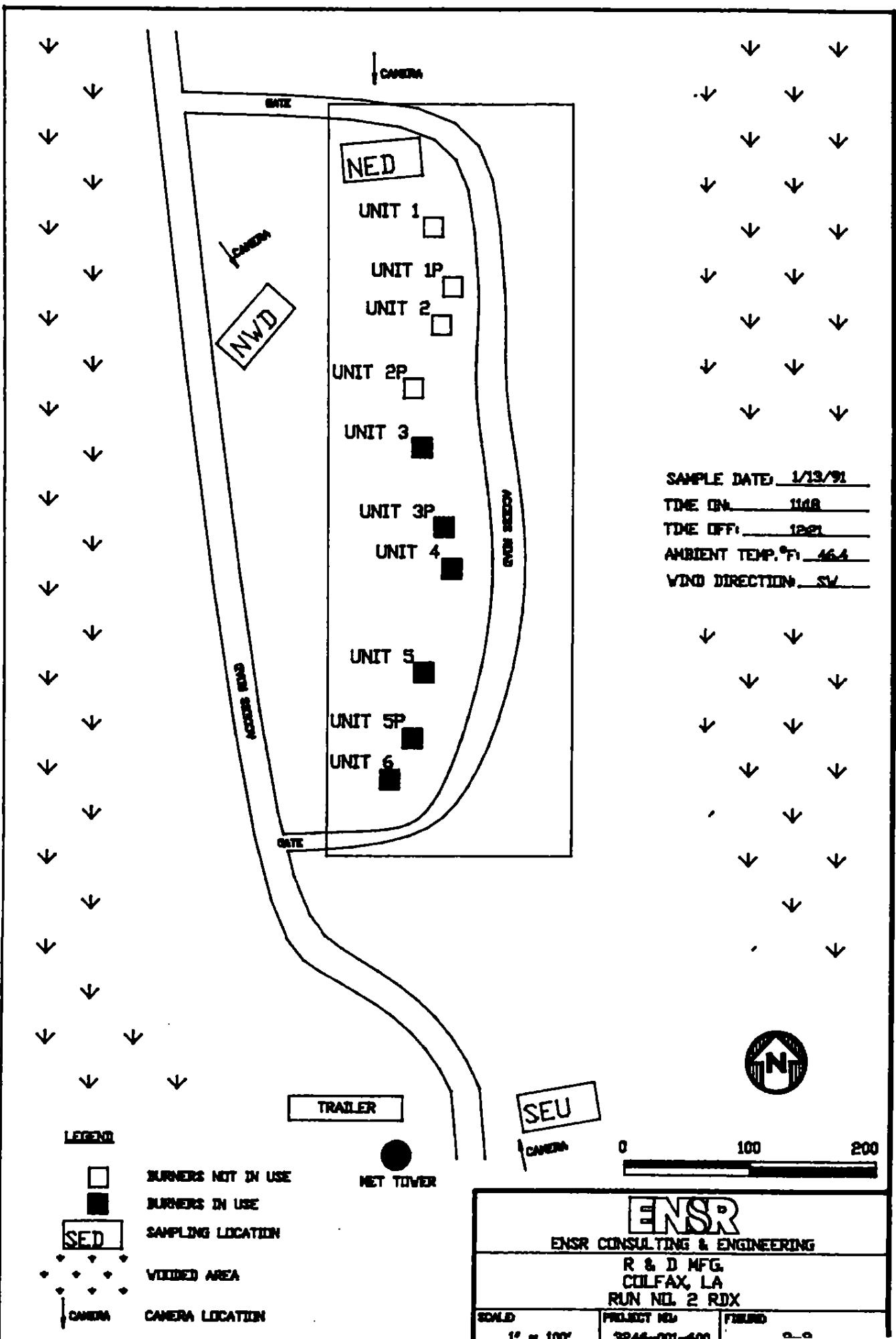
The first thermal treatment of RDX occurred between 15:10 and 16:20 on January 12, 1991. Ambient temperature was approximately 46°F, with winds from the west-northwest between approximately 3 and 7 mph. Eleven burns at 10 lbs/burn for a total of 110 lbs of RDX was required to allow sampling to occur over a one hour time period. Six treatment units located on the southern half of the facility were used during the measurement effort. The configuration and location of the thermal treatment units, the upwind and downwind sampling platforms, the meteorological tower and the video cameras are shown in Figure 2-1.

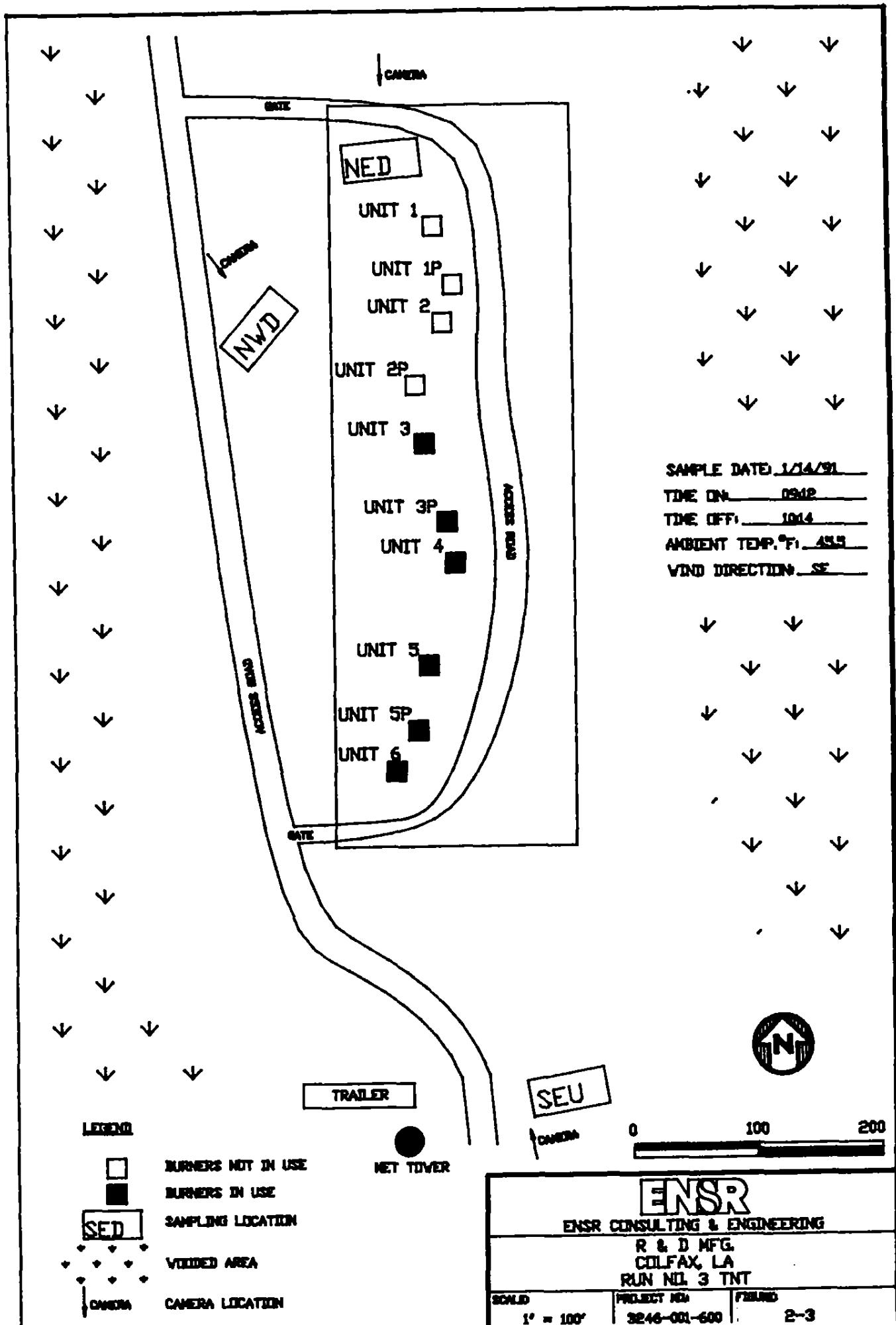
The second thermal treatment of RDX occurred between 11:15 and 12:25 on January 13, 1991. Ambient temperature was approximately 46°F, with winds from the south-southeast and south between approximately 3 and 5 mph. Twelve burns at 10 lbs/burn for a total of 120 lbs of RDX was required to allow sampling to occur over a one hour time period. Six treatment units located on the southern half of the facility were used during the measurement effort. The configuration and location of the thermal treatment units, the upwind and downwind sampling platforms, the meteorological tower and the video cameras are shown in Figure 2-2.

2.2.2 TNT Treatment

The first thermal treatment of TNT occurred between 09:12 and 10:12 on January 14, 1991. Ambient temperature was approximately 45°F, with winds from the southeast between approximately 5 and 6 mph. Six burns at 10 lbs/burn for a total of 60 lbs of TNT was required to allow sampling to occur over a one hour time period. Six treatment units located on the southern half of the facility were used during the measurement effort. The configuration and the location of the thermal treatment units, the upwind and downwind sampling platforms, the meteorological tower and the video cameras are shown in Figure 2-3. Due to an electrical







problem, the northeast downwind site accidentally shut-off after 5 minutes of sampling. This event did not compromise the overall integrity of the TNT runs.

The second thermal treatment of TNT occurred between 12:42 and 13:42 on January 14, 1991. Ambient temperature was approximately 58°F, with winds from the southeast between approximately 4.5 and 6.5 mph. Six burns at 10 lbs/burn for a total of 60 lbs of TNT was required to allow sampling to occur over a one hour time period. Six treatment units located on the southern half of the facility were used during the measurement effort. The configuration and the location of the thermal treatment units, the upwind and downwind sampling platforms, the meteorological tower and the video cameras are shown in Figure 2-4.

2.2.3 Lead Azide Detonator Treatment

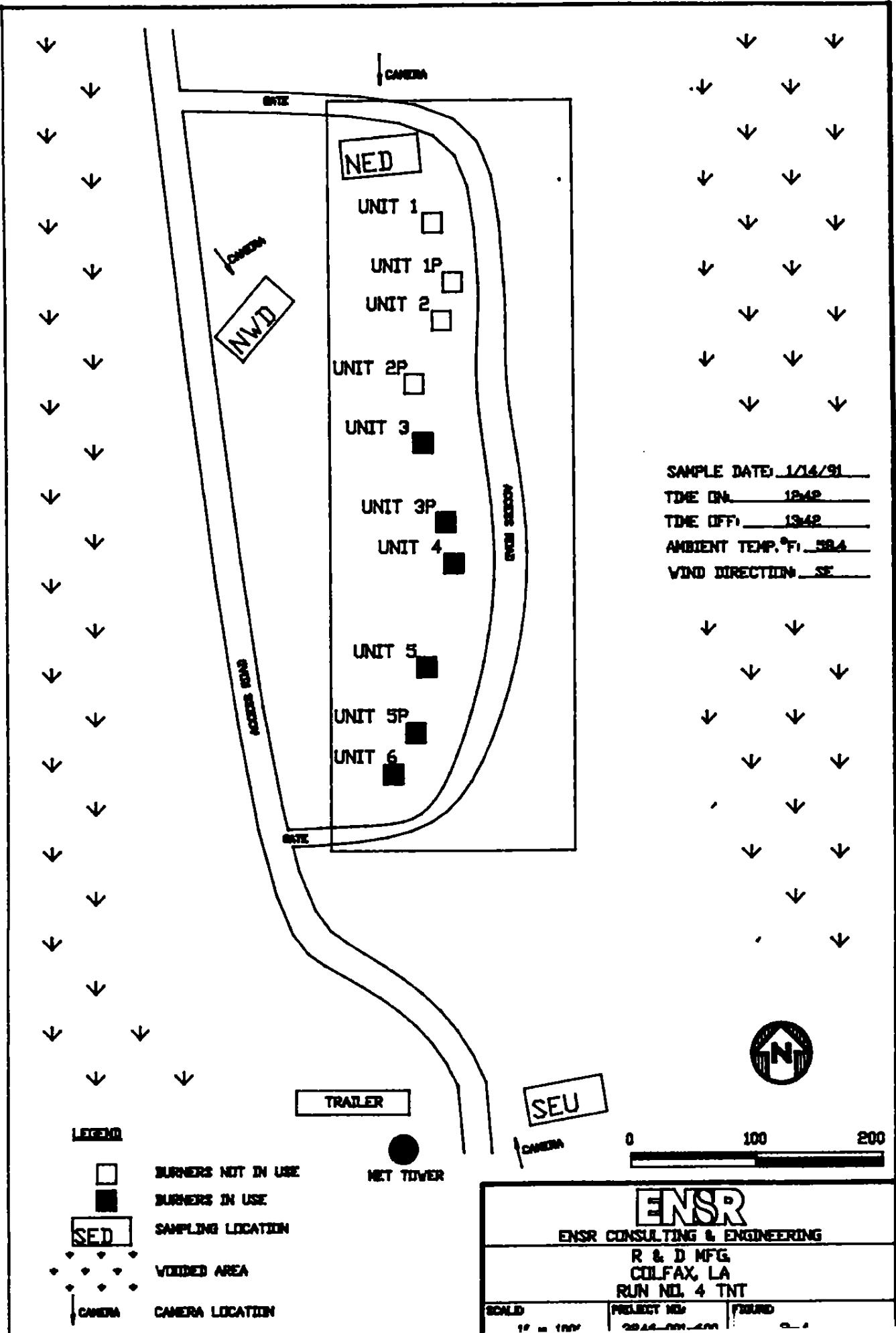
The first thermal treatment of lead azide detonators occurred between 15:45 and 16:45 on January 14, 1991. Ambient temperature was approximately 57°F, with winds from the southeast between approximately 4 and 5 mph. Six burns at 0.18 lbs lead azide, 10 lbs of foam and 20 lbs of aluminum and stainless steel casings per burn for a total of 180.7 lbs of detonators was required to allow sampling to occur over a one hour time period. Six treatment units located on the southern half of the facility were used during the measurement effort. The configuration and the location of the thermal treatment units, the upwind and downwind sampling platforms, the meteorological tower and the video cameras are shown in Figure 2-5.

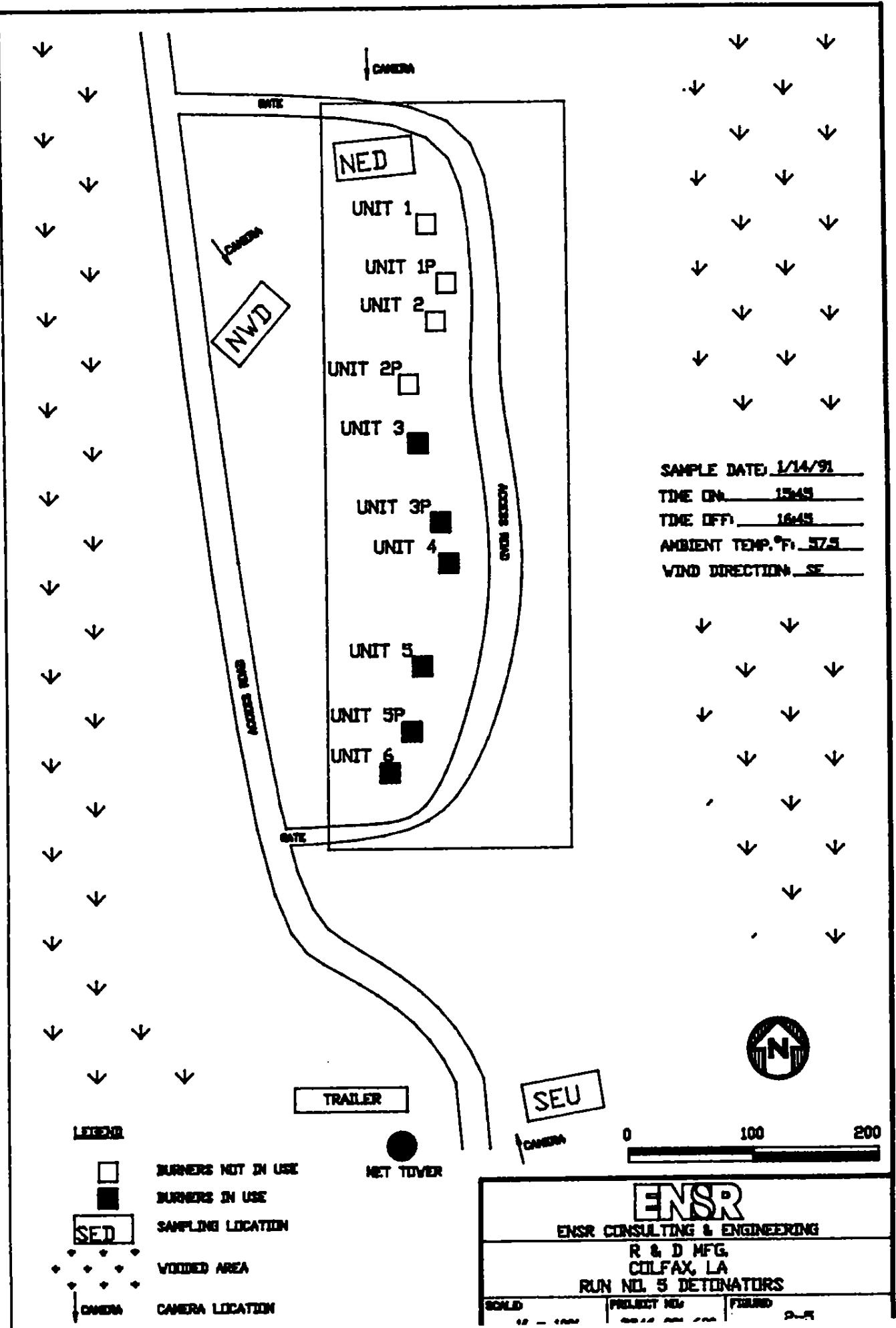
The second thermal treatment of lead azide detonators occurred between 10:38 and 11:39 on January 16, 1991. Ambient temperature was approximately 54°F, with winds from the northwest between approximately 3 and 7 mph. Six burns at 0.18 lbs lead azide, 10 lbs of foam and 20 lbs of aluminum and stainless steel casings per burn for a total of 180.7 lbs of detonators was required to allow sampling to occur over a one hour time period. Six treatment units located on the southern half of the facility were used during the measurement effort. The configuration and the location of the thermal treatment units, the upwind and downwind sampling platforms, the meteorological tower and the video cameras are shown in Figure 2-6.

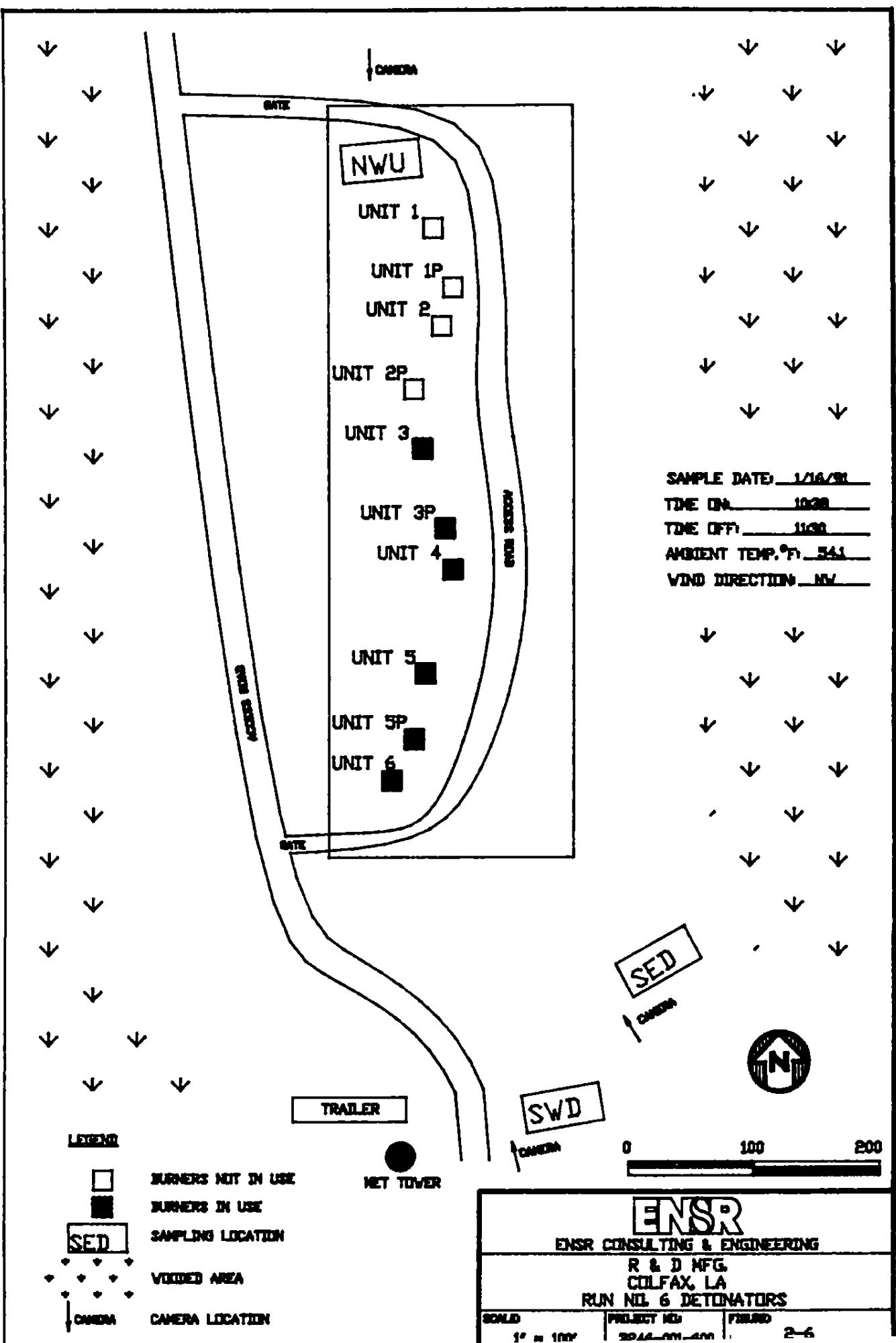
2.3 Results

2.3.1 Overview

As discussed in ENSR Document No. 3246-001-200, ENSR anticipated that the atmospheric concentrations of the target parameters would be near the detection limit of the state-of-the-art sampling and analytical procedures utilized in the study. This observation was based on the relatively small quantities of wastes treated per run at the R&D facility and due to the short-







duration (one hour) of each sampling run. During the source characterization effort, this initial observation was borne-out; many parameters were below quantitation limits in every sample. These parameters included 1-nitropyrene, phenol, nickel and selenium. In addition, many parameters were below quantitation limits in more than 75% of the samples, including; all of the PAHs, antimony, cadmium, ethylbenzene and xylenes. Based on the 1989 throughput quantities of 120,000 lbs and a 8 hr/day, 365 day/yr operating schedule, the maximum hourly capacity was approximately 42 lbs/hr. According to Mr. Richard Crain of R&D, typical thermal treatment batches vary from 15 to 30 lbs/hr. To achieve a sufficient treatment time interval for source testing, sampling data for RDX, TNT and lead azide detonators under thermal treatment required 110 to 120 lbs/hr, 60 lbs/hr, and 180.7 lbs/hr, respectively. Thus, the waste feed rate during the source sampling program was generally in excess of normal operating conditions at R&D. The present data should thus represent worst-case impacts from the R&D facility.

While the entire sample results are presented below and are utilized to develop pollutant specific emission rates, some thermal treatment runs are more informative than others. Thus RDX run #2 provided better upwind-downwind resolution than RDX run #1. Also, TNT run #4 provided better upwind-downwind resolution than TNT run #3. Both lead azide runs #5 and #6 provide adequate upwind-downwind resolution. Finally, because the site has been in use for thermal treatment for a number of years, it may be possible that trace amounts of some of the target parameters are contained in wind blown dust. Thus the upwind samplers serve to document this phenomenon. It was extremely important to compare upwind-downwind concentrations since the anticipated small quantities of the target chemicals collected could be adversely impacted by low-levels of background contaminants.

2.3.2 RDX Treatment

The results from thermal treatment runs #1 and #2 are shown in Tables 2-1 and 2-2. During run #1, only the downwind southwest sampler recorded measurable quantities of RDX above the upwind sampler. However, during run #2, downwind RDX concentrations were 2 to 3 times upwind levels at both downwind monitors. The PAHs were below quantitation limits for all RDX thermal treatment samples, as was phenol. The VOC and trace metal results do not provide an obvious trend between upwind-downwind sampling sites. Thus, RDX appears to be the best indicator of the emission trends from the thermal treatment of RDX.

TABLE 2-1
**MEASURED UPWIND AND DOWNDOWN POLLUTANT CONCENTRATIONS
FOR BURN #1 (WASTE RDX)^{a b c}**

Pollutant	NWU (µg/m³)	SED (µg/m³)	SWD (µg/m³)
Particulates	20.60	34.70	20.63
RDX	0.27	0.27	0.49
Aluminum	2.11	2.15	2.47
Barium	0.83	0.65	0.26
Chromium	0.01	0.01	0.01
Copper	0.16	0.15	0.07
Lead	<0.03	0.01	<0.03
Zinc	0.73	0.57	0.22
Benzene	0.10	1.67	0.31
Toluene	0.10	0.62	2.80
Ethylbenzene	0.40	0.37	0.38

a All concentrations are blank corrected.

b Concentrations for the following substances are below quantitation limits

Pollutant	Quantitation Limit (µg/m³)
1-Nitropyrene	0.006
Benzo(b)fluoranthenes	0.003
Benzo(j)fluoranthenes	0.003
Benzo(k)fluoranthenes	0.003
Benzo(e)pyrene	0.003
Benzo(a)pyrene	0.003
Indeno(c,d)pyrene	0.003
Dibenz(a,c/a,h)anthracene	0.003
Coronene	0.003
Phenol	0.068
Antimony	0.027
Cadmium	0.014
Nickel	0.136
Selenium	0.014
Total Xylenes	0.366

c NWU: Northwest Upwind Monitor
SED: Southeast Downwind Monitor
SWD: Southwest Downwind Monitor

TABLE 2-2

**MEASURED UPWIND AND DOWNDOWN POLLUTANT CONCENTRATIONS
FOR BURN #2 (WASTE RDX)^{a b c}**

<u>Pollutant</u>	<u>SEU ($\mu\text{g}/\text{m}^3$)</u>	<u>NED ($\mu\text{g}/\text{m}^3$)</u>	<u>NWD ($\mu\text{g}/\text{m}^3$)</u>
Particulates	<0.01	17.99	133.35
RDX	0.12	0.32	0.27
Aluminum	<0.01	0.04	0.98
Barium	<0.01	0.05	0.03
Chromium	<0.01	<0.01	0.08
Copper	0.03	0.06	0.16
Lead	<0.03	<0.03	0.03
Zinc	<0.01	0.11	0.20
Benzene	0.12	0.34	<0.37
Toluene	0.16	0.19	<0.37

a All concentrations are blank corrected.

b Concentrations for the following substances are below quantitation limits

<u>Pollutant</u>	<u>Quantitation Limit ($\mu\text{g}/\text{m}^3$)</u>
1-Nitropyrene	0.006
Benzo(b)fluoranthenes	0.003
Benzo(j)fluoranthenes	0.003
Benzo(k)fluoranthenes	0.003
Benzo(e)pyrene	0.003
Benzo(a)pyrene	0.003
Indeno(c,d)pyrene	0.003
Dibenz(a,c/a,h)anthracene	0.003
Coronene	0.003
Phenol	0.068
Antimony	0.027
Cadmium	0.014
Nickel	0.136
Selenium	0.014
Ethylbenzene	0.366
Total Xylenes	0.366

c SEU: Southeast Upwind Monitor
NED: Northeast Downwind Monitor
NWD: Northwest Downwind Monitor

2.3.3 TNT Treatment

The results from thermal treatment runs #3 and #4 are shown in Tables 2-3 and 2-4. During run #3, most pollutants were measured at low levels and TNT was found at levels below the quantitation limit. However, during run #4, downwind TNT concentrations were 10 to 30 times upwind levels at both downwind monitors. During run #4, a similar trend was found for 2,6-dinitrotoluene. The PAHs were below quantitation limits for all TNT thermal treatment samples, as was phenol. The VOC results do not provide an obvious trend between upwind-downwind sampling sites. However, specific trace metals (aluminum, cadmium, copper, and zinc) reveal clear differences between upwind-downwind sampling sites. Thus TNT and the trace metals appear to be the best indicators of emission trends from the thermal treatment of TNT.

2.3.4 Lead Azide Detonator Treatment

The results from thermal treatment runs #5 and #6 are shown in Tables 2-5 and 2-6. During runs #5 and #6, downwind lead concentrations were 50 to 100 times upwind levels at both downwind monitors. During both sampling runs, a similar trend was found for antimony, barium, and copper. For the PAHs, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(e)pyrene, benzo(a)pyrene, and indeno(c,d)pyrene were found at higher concentrations at downwind locations than upwind sites during both sampling runs. The benzene and toluene results also provide an obvious trend between upwind-downwind sampling sites. However, as with the other waste streams, all phenol results were below quantitation limits. Thus Pb, selected trace metals, PAHs and VOCs appear to be the best indicators of emission trends from the thermal treatment of lead azide detonators.

2.4 Discussion

2.4.1 Quality Objectives

Most of the data quality objectives for the project were met or exceeded. Target compound quantitation limit goals were generally met for all classes of pollutants except phenol. The phenol quantitation limit for the present study was estimated at approximately 25 ppb_v. System precision (%RSD), based on co-located samplers, was estimated for the relevant parameters as follows: Particulates ($\pm 14\%$), RDX ($\pm 42\%$), PAHs, based on BaP ($\pm 1\%$), VOC, based on benzene ($\pm 46\%$), DNT/TNT, based on TNT ($\pm 17\%$) and phenol ($\pm 0\%$). Most of the precision values are similar to or better than the precision goals for the study. However, due to the small number of samples and hence co-locates collected, the likelihood of deviations from the precision goals are enhanced. Metals precision estimates, based on duplicate analysis of two filters varied between $\pm 1\%$ to $\pm 17\%$, depending on the trace metal. Accuracy and

TABLE 2-3
**MEASURED UPWIND AND DOWNDOWN POLLUTANT CONCENTRATIONS
FOR BURN #3 (WASTE TNT)^{a b c}**

<u>Pollutant</u>	<u>SEU ($\mu\text{g}/\text{m}^3$)</u>	<u>NED ($\mu\text{g}/\text{m}^3$)</u>	<u>NWD ($\mu\text{g}/\text{m}^3$)</u>
Particulates	14.09	181.30	90.90
Aluminum	<0.01	<0.01	0.33
Barium	<0.01	<0.01	0.02
Chromium	<0.01	0.03	0.01
Copper	0.01	0.46	0.11
Zinc	0.01	0.60	0.10
Benzene	1.64	1.55	1.08
Toluene	1.60	1.51	0.88
Total Xylenes	1.13	0.83	0.36
2,6 Dinitrotoluene	<0.01	0.01	<0.01

a All concentrations are blank corrected.

b Concentrations for the following substances are below quantitation limits

<u>Pollutant</u>	<u>Quantitation Limit ($\mu\text{g}/\text{m}^3$)</u>
1-Nitropyrene	0.006
Benzo(b)fluoranthenes	0.003
Benzo(j)fluoranthenes	0.003
Benzo(k)fluoranthenes	0.003
Benzo(e)pyrene	0.003
Benzo(a)pyrene	0.003
Indeno(c,d)pyrene	0.003
Dibenz(a,c/a,h)anthracene	0.003
Coronene	0.003
Phenol	0.068
Antimony	0.027
Cadmium	0.014
Lead	0.027
Nickel	0.136
Selenium	0.014
Ethylbenzene	0.366
2,4 Dinitrotoluene	0.016
2,4,6 Trinitrotoluene	0.016

c SEU: Southeast Upwind Monitor
NED: Northeast Downwind Monitor
NWD: Northwest Downwind Monitor

TABLE 2-4

**MEASURED UPWIND AND DOWNDOWN POLLUTANT CONCENTRATIONS
FOR BURN #4 (WASTE TNT)^{a,b,c}**

<u>Pollutant</u>	<u>SEU ($\mu\text{g}/\text{m}^3$)</u>	<u>NED ($\mu\text{g}/\text{m}^3$)</u>	<u>NWD ($\mu\text{g}/\text{m}^3$)</u>
Particulates	9.71	57.91	70.97
Aluminum	<0.01	0.29	0.11
Barium	<0.01	<0.01	0.08
Cadmium	0.02	0.01	0.03
Copper	0.01	0.34	0.09
Lead	<0.03	0.03	0.01
Zinc	<0.01	0.18	0.47
Benzene	0.62	0.70	0.22
Toluene	0.70	0.43	0.26
2,6 Dinitrotoluene	<0.01	0.203	0.003
2,4 Dinitrotoluene	0.01	0.055	<0.01
2,4,6 Trinitrotoluene	<0.001	0.359	0.118

a All concentrations are blank corrected.

b Concentrations for the following substances are below quantitation limits

<u>Pollutant</u>	<u>Quantitation Limit ($\mu\text{g}/\text{m}^3$)</u>
1-Nitropyrene	0.006
Benzo(b)fluoranthenes	0.003
Benzo(j)fluoranthenes	0.003
Benzo(k)fluoranthenes	0.003
Benzo(e)pyrene	0.003
Benzo(a)pyrene	0.003
Indeno(c,d)pyrene	0.003
Dibenz(a,c/a,h)anthracene	0.003
Coronene	0.003
Phenol	0.068
Antimony	0.027
Chromium	0.014
Nickel	0.136
Selenium	0.014
Ethylbenzene	0.366
Total Xylenes	0.366

c SEU: Southeast Upwind Monitor
NED: Northeast Downwind Monitor
NWD: Northwest Downwind Monitor

TABLE 2-5

**MEASURED UPWIND AND DOWNWIND POLLUTANT CONCENTRATIONS
FOR BURN #5 (LEAD AZIDE DETONATORS)^{a b c}**

<u>Pollutant</u>	<u>SEU ($\mu\text{g}/\text{m}^3$)</u>	<u>NED ($\mu\text{g}/\text{m}^3$)</u>	<u>NWD ($\mu\text{g}/\text{m}^3$)</u>
Particulates	19.42	45.32	109.04
Benzo(b)fluoranthenes	0.003	0.009	0.014
Benzo(j)fluoranthenes	0.003	0.005	0.008
Benzo(e)pyrene	0.003	0.014	0.021
Benzo(a)pyrene	0.003	0.008	0.013
Indeno(c,d)pyrene	0.003	0.010	0.013
Aluminum	<0.01	0.92	1.40
Antimony	0.02	0.11	0.22
Barium	<0.01	0.14	0.20
Cadmium	0.01	0.02	0.02
Copper	0.04	0.07	0.17
Lead	0.05	2.59	5.65
Zinc	<0.01	0.16	0.15
Benzene	0.42	1.70	6.81
Toluene	0.23	0.56	1.61
Ethylbenzene	0.37	0.37	0.89

a All concentrations are blank corrected.

b Concentrations for the following substances are below quantitation limits

<u>Pollutant</u>	<u>Quantitation Limit ($\mu\text{g}/\text{m}^3$)</u>
1-Nitropyrene	0.006
Benzo(k)fluoranthenes	0.003
Dibenz(a,c/a,h)anthracene	0.003
Coronene	0.003
Phenol	0.068
Chromium	0.014
Nickel	0.136
Selenium	0.014
Total Xylenes	0.366

c SEU: Southeast Upwind Monitor
NED: Northeast Downwind Monitor
NWD: Northwest Downwind Monitor

TABLE 2-6

**MEASURED UPWIND AND DOWNDOWN POLLUTANT CONCENTRATIONS
FOR BURN #6 (LEAD AZIDE DETONATORS)^{a b c}**

<u>Pollutant</u>	<u>NWU</u> ($\mu\text{g}/\text{m}^3$)	<u>SED</u> ($\mu\text{g}/\text{m}^3$)	<u>SWD</u> ($\mu\text{g}/\text{m}^3$)
Particulates	40.87	159.66	54.91
Benzo(b)fluoranthenes	0.003	0.014	0.007
Benzo(j)fluoranthenes	0.003	0.010	0.005
Benzo(e)pyrene	0.003	0.026	0.011
Benzo(a)pyrene	0.003	0.019	0.008
Indeno(c,d)pyrene	0.003	0.017	0.007
Coronene	0.003	0.008	0.003
Aluminum	<0.01	3.58	1.23
Antimony	0.03	0.15	0.08
Barium	<0.01	0.18	0.06
Cadmium	0.01	0.05	0.02
Chromium	<0.01	0.06	<0.01
Copper	0.09	1.30	0.42
Lead	<0.03	4.10	1.86
Zinc	0.10	0.26	0.08
Benzene	1.11	4.95	5.05
Toluene	1.07	1.10	1.46
Ethylbenzene	0.37	0.38	0.38
Total Xylenes	0.37	0.38	0.50

a All concentrations are blank corrected.

b Concentrations for the following substances are below quantitation limits

<u>Pollutant</u>	<u>Quantitation Limit</u> ($\mu\text{g}/\text{m}^3$)
1-Nitropyrene	0.006
Benzo(k)fluoranthenes	0.003
Dibenz(a,c/a,h)anthracene	0.003
Phenol	0.068
Nickel	0.136
Selenium	0.014

c NWU: Northwest Upwind Monitor
 SED: Southeast Downwind Monitor
 SWD: Southwest Downwind Monitor

completeness goals were met for virtually all parameters. Bromofluorobenzene was spiked on every VOST cartridge sent to the field. Average recoveries for bromofluorobenzene were 92.2% with a range from 55% to 126%. Trace metal analysis based on spiked filters produced an accuracy estimate between 5% and 39%, depending on the target substance. For RDX, spiked filters produced an accuracy of 13%, while surrogate recoveries for the PAHs produced accuracies of between 1% and 27%. The phenol accuracy was approximately 1% based a 0.098 µg/ml spike of a field sample. No accuracy values are available for DNT/TNT since the estimated spiked amount was below the final method detection limit. All laboratory results for this project, including data for the addition of spikes and surrogates, are contained in Appendix A.

2.4.2 Summary of Findings

The overall sampling design successfully measured plume concentrations of the target chemical parameters resulting from the thermal treatment operation. The R&D thermal treatment facility represents a difficult release configuration and process operation for a source characterization program. Because of the lack of previous sampling experience for this type of thermal treatment operation, the sampling program required that certain assumptions be made regarding the anticipated concentrations of the target parameters and the sensitivity of the sampling and analytical procedures based on relatively short sampling times. Most of these assumptions proved to be correct, however, it should be emphasized that a significant number of parameters were generally found below the quantitation limits. These chemicals include phenol, PAHs, nickel, selenium, antimony, cadmium, ethylbenzene and total xylenes. These results suggest that off-site impacts for these chemicals are anticipated to be negligible.

The results from the present effort suggest that specific target chemicals best reflect the impacts from each of the thermal treatment runs. The most informative chemical for the RDX runs is RDX, for the TNT runs is TNT and for lead azide detonator runs is lead. These data will form the basis for the emission estimates, dispersion modeling and health risk assessment.

3.0 EMISSION RATE ESTIMATION AND DISPERSION MODELING

3.1 Introduction

The purpose of the work summarized in the present chapter is to:

- Develop the source emission rate estimates, and
- Support the health risk assessment.

This section presents the methodology and results of the emissions estimation analysis and the dispersion model analyses performed for the health risk assessment.

3.2 Methodology

The suitability of an air quality dispersion model for a particular application is dependent upon several factors. In this study four selection criteria were evaluated. These criteria were:

- Dispersion environment,
- Source type,
- Averaging periods of concern, and
- Availability of representative meteorological data.

3.2.1 Dispersion Environment

Land use within a 3 kilometer radius of the facility was examined in accordance with the land use classifications of Auer (1978). Areas representative of urban and rural environments were identified from U.S. Geologic Survey (USGS) topographic maps (see Figure 1-1). The dispersion environment surrounding the R&D facility is predominantly rural, therefore, rural dispersion coefficients were used in the model analysis.

3.2.2 Source Description

The thermal treatment system at the R&D facility presents an unusual release configuration and process operation. The thermal treatment system consist of circular 4 ft diameter and 3 ft high cement units. The wastes are placed in the units and ignited using diesel fuel to begin the thermal treatment process. Depending upon the type of waste treated, the thermal treatment process lasts approximately 5 to 15 minutes. The wastes burn at relatively high temperatures

and observations of the process indicate that there is a moderate amount of plume rise due to plume buoyancy. There are three methods for simulating an emission source in a dispersion model: point, volume, and area. The thermal treatment system at R&D is most analogous to a series of volume sources. Therefore, a model capable of simulating a volume source type was required.

3.2.3 Averaging Period of Concern

To develop emission rates for the R&D facility a model capable of simulating short-term (i.e., 1-hour) impacts is required. Conversely, since the health risk assessment is focused on the long-term chronic effects, estimation of annual average impacts is necessary to complete this analysis. Therefore, a dispersion model which predicts both short-term and long-term concentrations was required.

3.2.4 Meteorological Data

Meteorological data used in dispersion modeling is typically of two forms: hourly data and annual average data. Hourly meteorological data was collected during the ambient monitoring program. This data consisted of wind speed, wind direction, sigma-theta, and ambient temperature. A description of the meteorological monitoring system is given in the report "Final Source Characterization Plan for the R&D Thermal Treatment System, September 1990", ENSR Document No. 3246-001-200. These data were utilized to estimate pollutant specific emission rates.

Hourly meteorological data was also obtained from the Alexandria Airport for the period of the monitoring study. Pasquill-Gifford (P-G) atmospheric stability classes were calculated based on observed cloud cover at the Alexandria Airport and the on-site wind data using the algorithms found in the standard EPA RAMMET meteorological data preprocessor. Table 3-1 summarizes the observed wind speed, wind direction, and stability data for each of the monitoring runs.

Meteorological data used in the long-term dispersion model analysis consisted of five individual joint frequency (STAR) distributions of wind speed, wind direction, and atmospheric stability. The STAR distributions were based on observations from the Alexandria, LA airport for the years 1972-1976 and were obtained from the National Climatic Data Center.

Since facility operations at R&D are restricted to daytime hours only, nighttime stability classes (i.e., D-night, E, and F) were eliminated from each of the STAR distributions and the distributions renormalized to 1. The daytime wind roses are depicted in Figures 3-1 through 3-5.

TABLE 3-1
SUMMARY OF METEOROLOGICAL DATA

Run No.	Wind Speed (mph)	Wind Direction ⁽¹⁾ (deg)	P-G Stability Class
1	4.3	312	A
2	3.6	173	A
3	5.1	148	B
4	5.1	141	A
5	4.5	142	A
6	4.5	321	A

(1) Vector Average Wind Direction

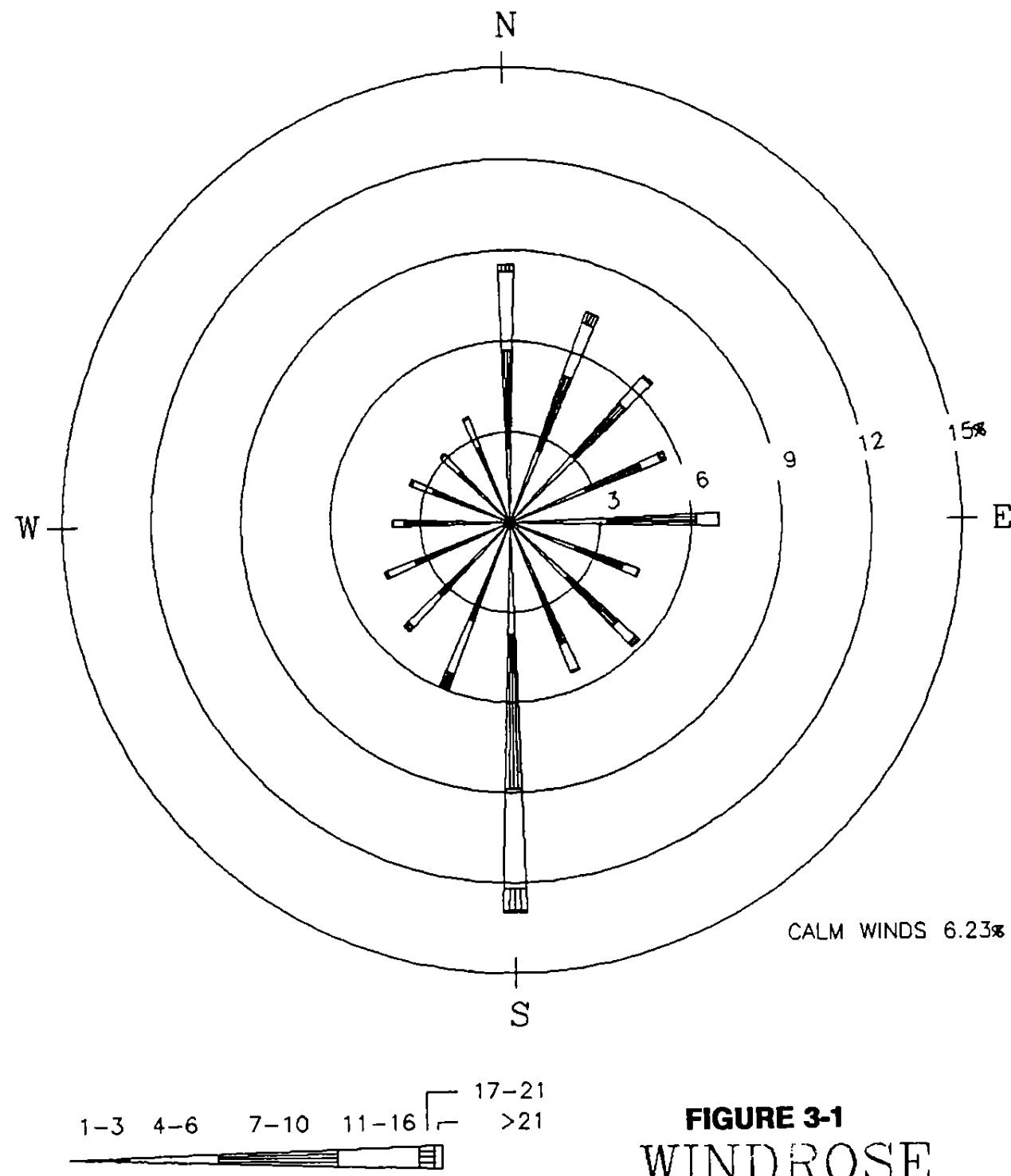
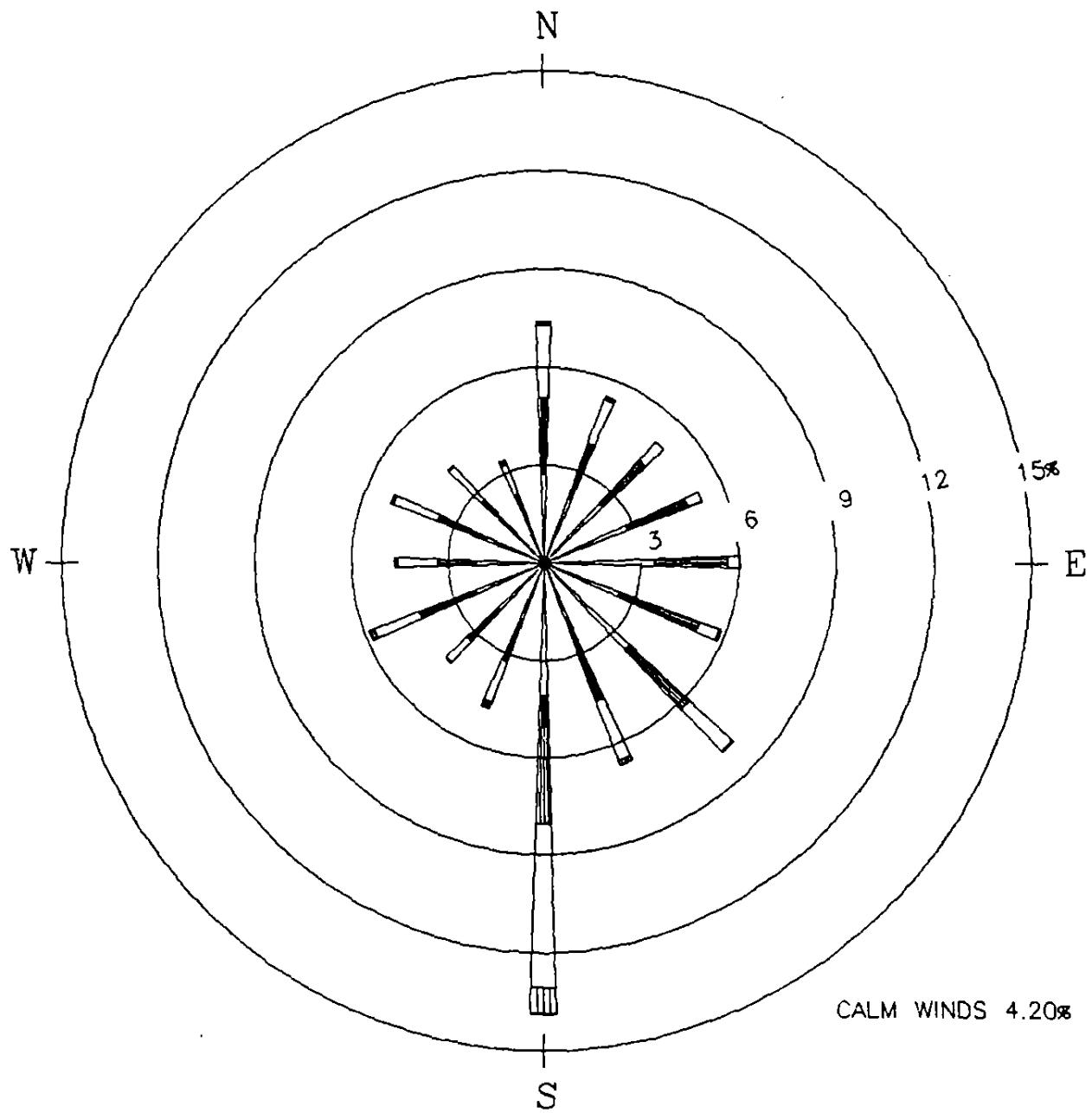


FIGURE 3-1
WINDROSE
 STATION NO. 13935
 Alexandria, LA
 PERIOD: 1972
 STABILITY CLASS: 1-4

NOTES:
 DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION.
 WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING.
 EXAMPLE - WIND IS BLOWING FROM THE NORTH 8.5 PERCENT OF THE TIME.



WIND SPEED CLASSES
(KNOTS)

NOTES:
DIAGRAM OF THE FREQUENCY OF
OCCURRENCE FOR EACH WIND DIRECTION.
WIND DIRECTION IS THE DIRECTION
FROM WHICH THE WIND IS BLOWING.
EXAMPLE - WIND IS BLOWING FROM THE
NORTH 7.4 PERCENT OF THE TIME.

FIGURE 3-2
WINDROSE
STATION NO. 13935
Alexandria, LA
PERIOD: 1973
STABILITY CLASS: 1-4

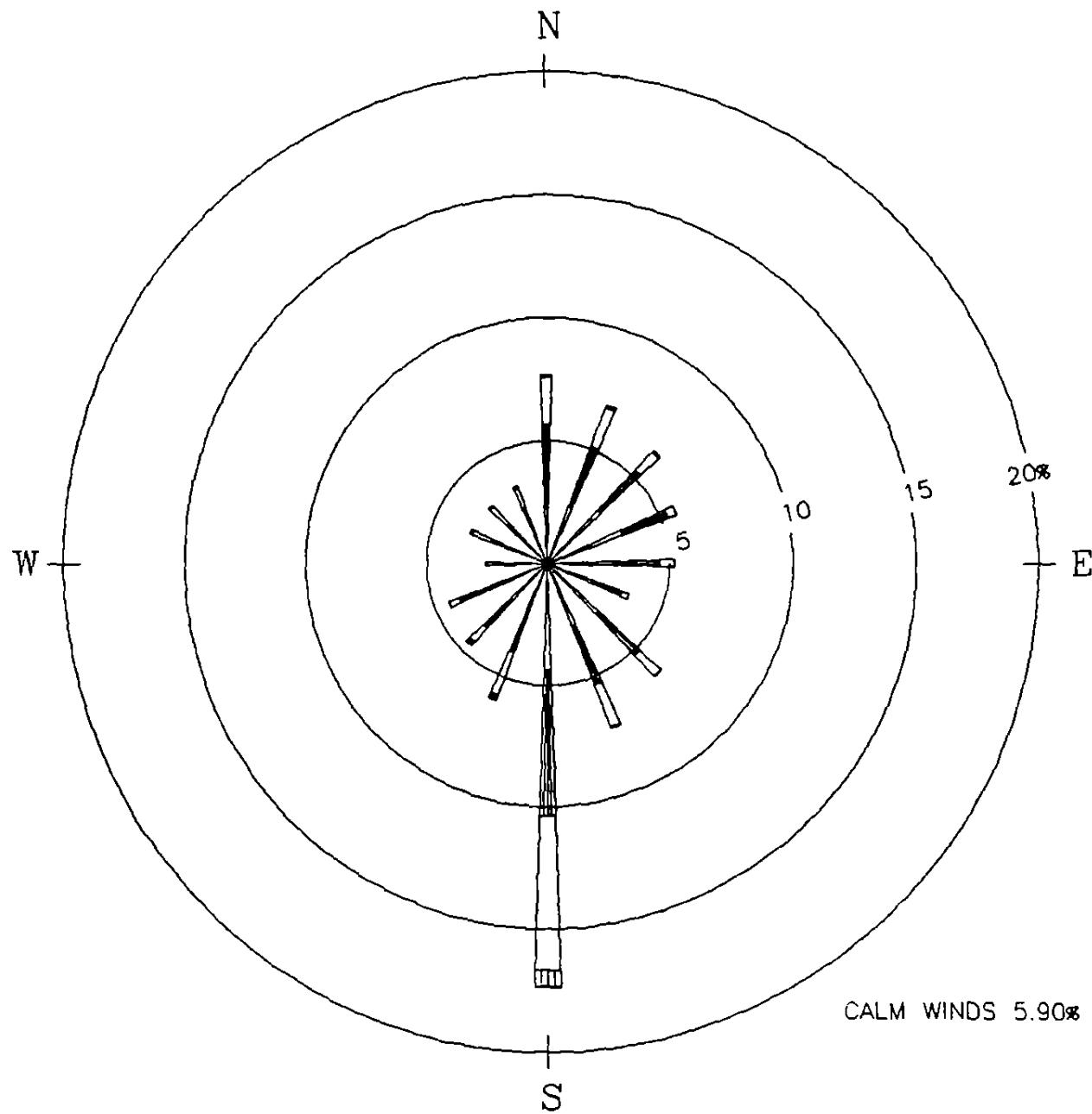


FIGURE 3-3
WINDROSE

WIND SPEED CLASSES
(KNOTS)

NOTES:
DIAGRAM OF THE FREQUENCY OF
OCCURRENCE FOR EACH WIND DIRECTION.
WIND DIRECTION IS THE DIRECTION
FROM WHICH THE WIND IS BLOWING.
EXAMPLE - WIND IS BLOWING FROM THE
NORTH 7.7 PERCENT OF THE TIME.

Alexandria, LA
PERIOD: 1974
STABILITY CLASS: 1-4

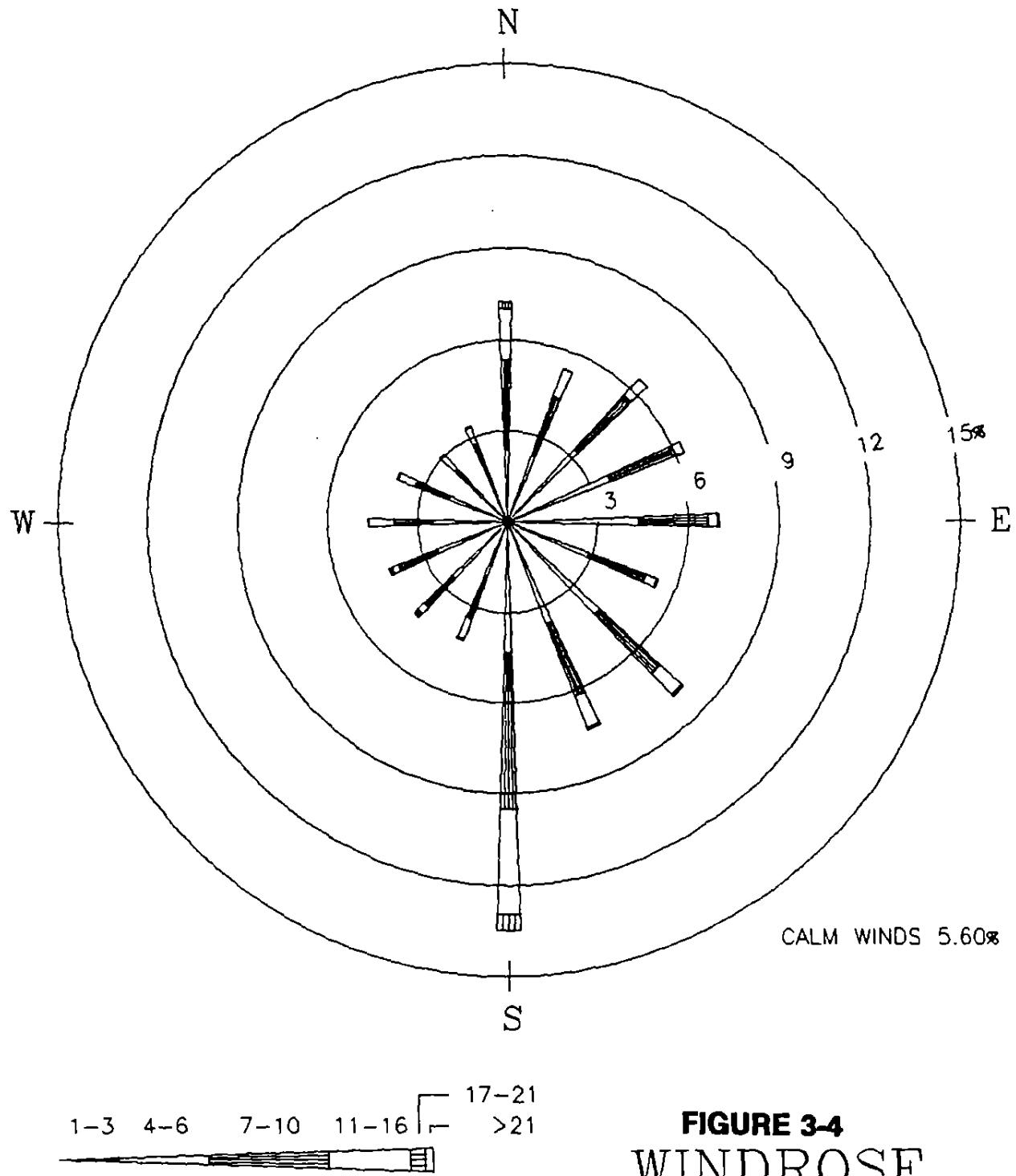


FIGURE 3-4
WINDROSE
 STATION NO. 13935
 Alexandria, LA
 PERIOD: 1975
 STABILITY CLASS: 1-4

WIND SPEED CLASSES
 (KNOTS)

NOTES:
 DIAGRAM OF THE FREQUENCY OF
 OCCURRENCE FOR EACH WIND DIRECTION.
 WIND DIRECTION IS THE DIRECTION
 FROM WHICH THE WIND IS BLOWING.
 EXAMPLE - WIND IS BLOWING FROM THE
 NORTH 7.3 PERCENT OF THE TIME.

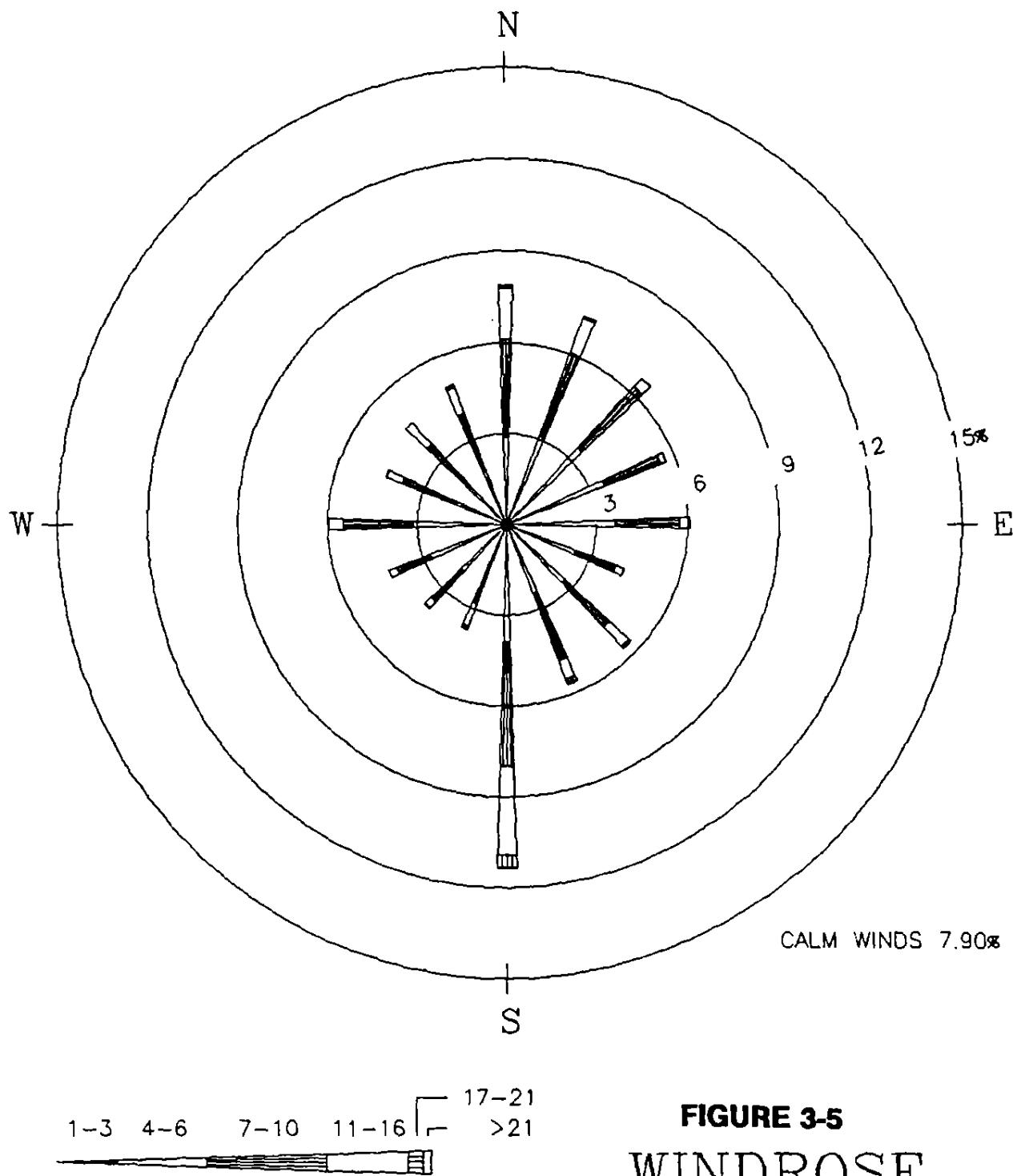


FIGURE 3-5
WINDROSE
 STATION NO. 13935
 Alexandria, LA
 PERIOD: 1976
 STABILITY CLASS: 1-4

NOTES:
 DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION.
 WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING.
 EXAMPLE - WIND IS BLOWING FROM THE NORTH 7.9 PERCENT OF THE TIME.

WIND SPEED CLASSES (KNOTS)

Note that model predictions based on these daytime wind roses represent the impact occurring during daytime hours only, since the facility does not operate at night, the impact is zero during this time period.

3.2.5 Summary

Based on the above discussion, the EPA Industrial Source Complex (ISC) models were used in this study. The ISC short-term (ISCST) model was used in the emissions estimation analysis and the ISC long-term (ISCLT) model was used to support the health risk assessment analysis. These models have the following capabilities which were be used in the analyses:

- Ability to simulate rural dispersion,
- Ability to simulate volume source types,
- Ability to simulate short-term impacts with hourly meteorological data, and
- Ability to simulate annual average impacts with STAR distribution meteorological data.

Model technical options used in the study are given in Table 3-2. These options represent the default options as specified by the regulatory default switch.

3.3 Emission Rate Estimation

3.3.1 Source Parameters

The thermal treatment system was modeled as a series of volume sources. The required source inputs for a volume source are:

- Emission rate,
- Location,
- Release height,
- Initial vertical dimension,
- Initial horizontal dimension.

A normalized emission rate was used for the source characterization portion of the model analysis. Annual emissions were estimated based on the results of the dispersion model analysis and are discussed in Section 3.3.4.

The location of the individual cement units are shown in Figures 2-1 through 2-6. The height of the emissions source was 20 feet which was the height of the monitors which were elevated on the manlifts.

TABLE 3-2
ISC MODEL OPTIONS

Model Option
Rural P-G Dispersion Coefficients
Final Plume Rise
Buoyancy-Induced Dispersion
Default Wind Speed Profile Exponents
Default Vertical Potential Temperature Lapse Rates
Anemometer Height 10 m (ISCST)
Anemometer Height 6.4 m (ISCLT)
No Pollutant Decay

The initial vertical dimension, σ_{z0} , and the initial horizontal dimension, σ_{yo} , were estimated based on observations taken during the measurement program and in accordance with guidance in the Industrial Source Complex Dispersion Model User's Guide (EPA, 1987). The initial vertical dimension was based on observations of plume rise made during the source testing program. These observations indicate that the plume centerline was approximately 20 ft (6 m) above ground, therefore, σ_{z0} was 2.8 meters (6 + 2.15).

Observation of initial horizontal plume growth in the immediately above the source indicate that the plume diameter is approximately three times the width of the cement bunker, i.e., approximately 12 ft. This observation agrees with the relationship for plume growth found in the *Handbook on Atmospheric Diffusion* (Hanna et al., 1982). This equation correlates plume radius to plume rise. The equation is:

$$R = 0.15z + R_o$$

where:

R is the plume radius,
z is the plume rise, and
 R_o is the initial radius.

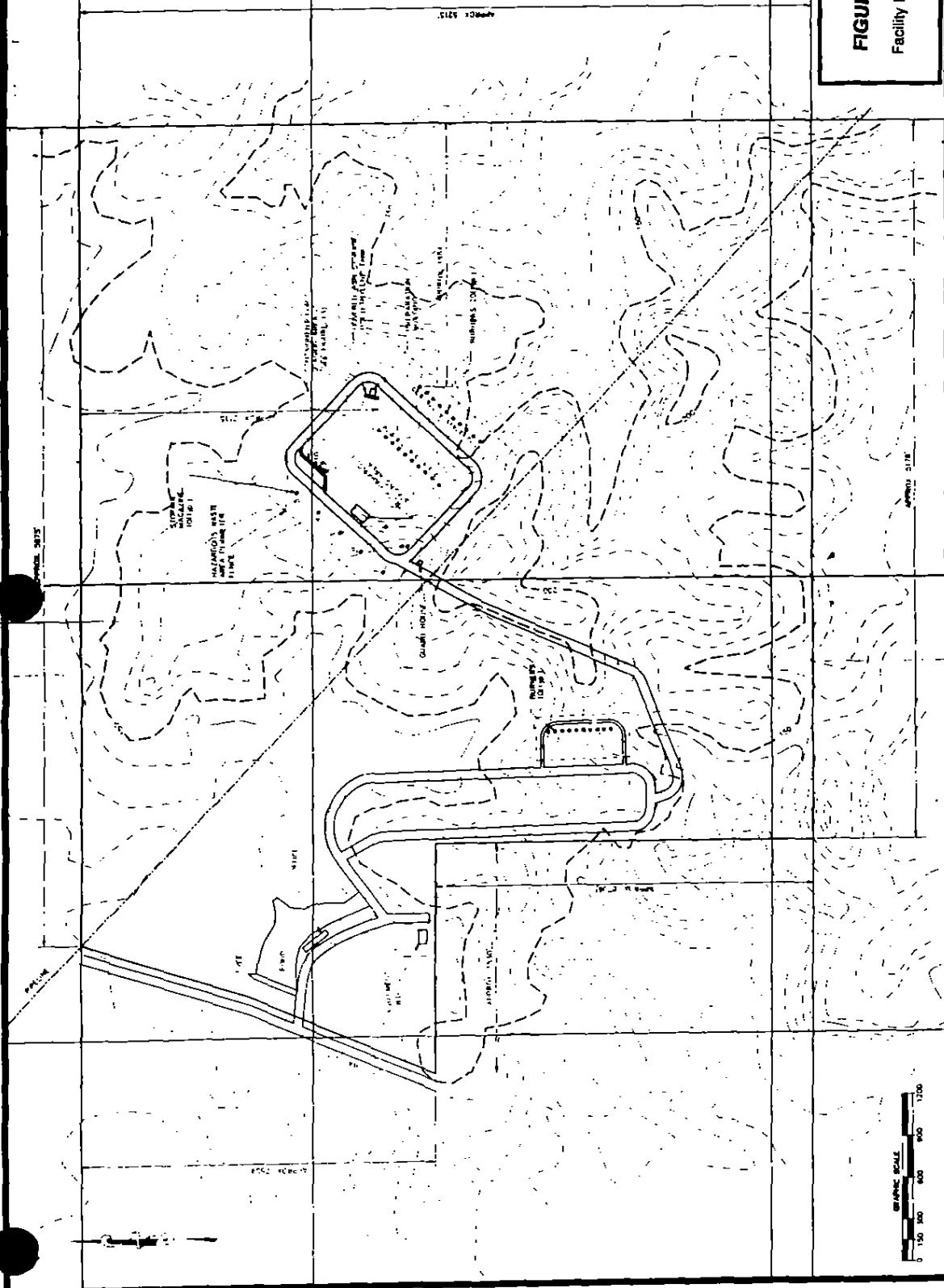
Plume diameter based on this equation is 10 ft (3 m). Using this diameter, σ_{yo} is 1.4 meters (3 + 2.15).

3.3.2 Receptor Data

Receptors for the ISCST model analysis were placed at the downwind monitor sites. These sites, and their relationship to the treatment units are shown in Figures 2-1 through 2-6. A total of 373 receptors were modeled in the ISCLT analysis. The receptors were arranged in a polar style receptor grid centered on the thermal treatment system. The polar grid consisted of 16 radials centered on each of the 16 wind direction sectors of the STAR frequency distribution with receptor rings spaced 100 meters apart extending to 3 km from the facility. All receptors within fenced plant property were eliminated from this grid. Figure 3-6 is a facility plot plan which shows the location of the treatment units and the property fenceline. The receptor grid was supplemented with 32 fenceline receptors spaced at 11.25 degree intervals. Figure 3-7 depicts the receptor grid on a USGS topographic map.

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FIGURE 3-6
Facility Plot Plan



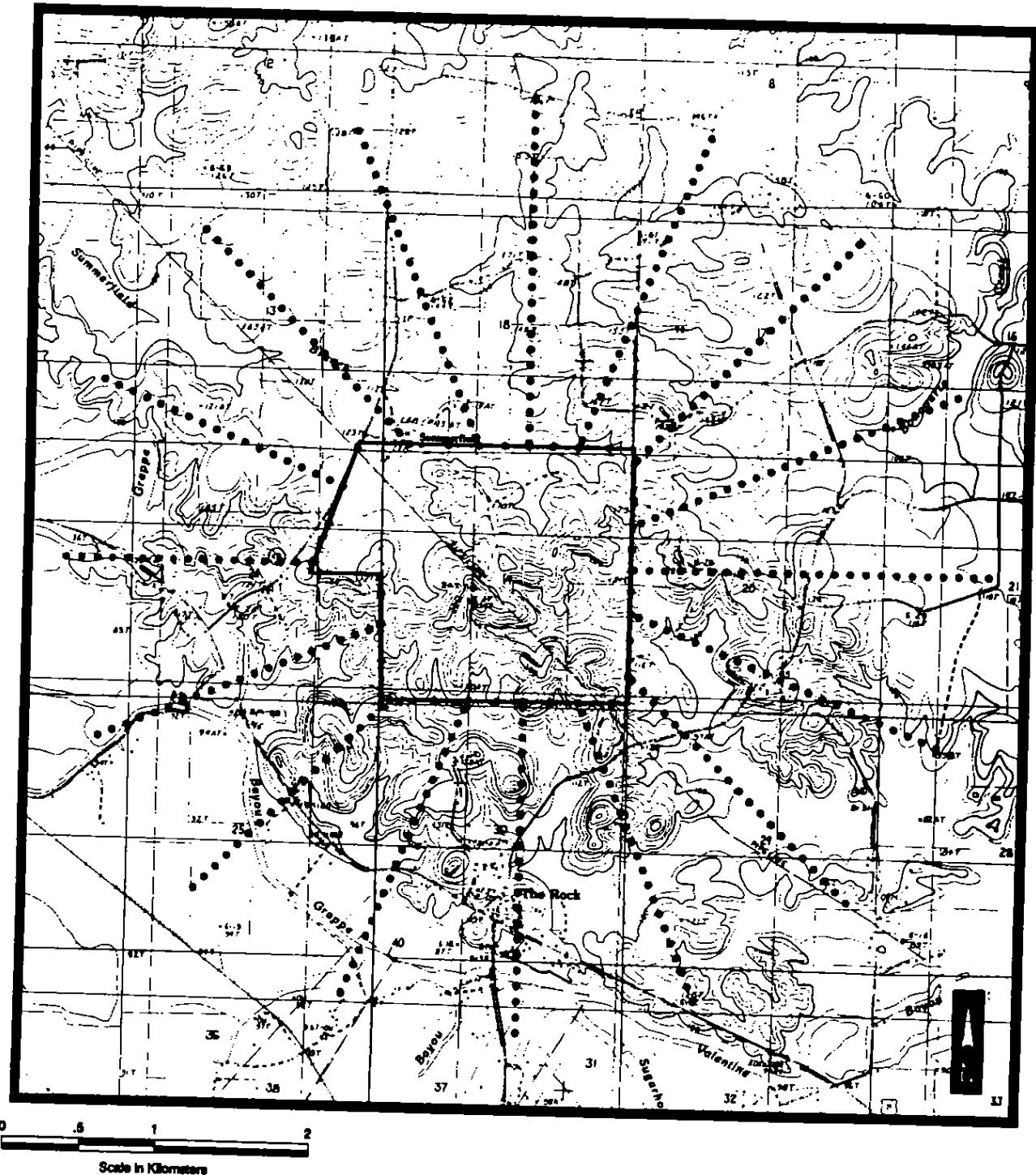


FIGURE 3-7
ISCLT Receptor Locations

3.3.3 ISCST Model Results

The results of the ISCST model analysis are shown in Table 3-3. This table lists the predicted concentration at each downwind monitor for each of the six thermal treatments. The modeled concentrations presented are based on a unit emission rate of 1 g/s per operating treatment unit.

The results of the ISCST analysis shows that the model predicted a concentration at each monitor for each of the six treatments. Of the pollutants monitored, particulates were expected to be measured at the highest precisions, since many of the other parameters were at or near their method quantitation limits. Information contained in Table 3-4 compares the ISCST model results and the observed particulate concentrations at the downwind monitors. The observed particulate concentrations are corrected for upwind observations and blank concentrations. For four of the six treatments, the modeled maximum impact and the maximum observed particulate concentration occurred at the same receptor monitor. For Treatment #2, the location of the modeled maximum impact and the observed particulate maximum concentration do not agree. For Treatment #3, one of the downwind monitors malfunctioned so a comparison can not be made. However, the observed particulate concentration at the functioning monitor for this treatment was the fourth highest of the 11 downwind particulate observations. It is therefore likely that the observed concentration at the functioning monitor would have been higher than that at the malfunctioning monitor. This would agree with the ISCST results for this treatment since the model predicted higher impacts at the functioning monitor site than the malfunctioning monitor site.

3.3.4 Emission Rate Estimates

Pollutant emission rates were estimated through a combination of dispersion modeling and ambient monitoring. The results of the ISCST dispersion model analysis were used to "back calculate" the actual emission rate based on the ratio of the observed and predicted pollutant concentrations.

The predicted impacts based on the unitized emission rate are shown in Table 3-3. These predicted impacts are based on a unitized per treatment unit emission rate of 1 g/s. To calculate the actual pollutant emission rate for each run, the following formula was used:

$$ER = \left(\frac{OC}{PC} \right) \times NP \quad (3-2)$$

TABLE 3-3
SUMMARY OF ISCST MODEL RESULTS

Run No.	SE Monitor	SW Monitor	NW Monitor	NE Monitor
1	1409.7	313.0	Upwind	Upwind
2	Upwind	Upwind	791.7	2003.5
3	Upwind	Upwind	1925.4	768.2
4	Upwind	Upwind	1758.1	458.8
5	Upwind	Upwind	1987.9	576.5
6	1471.6	656.6	Upwind	Upwind

All concentrations in $\mu\text{g}/\text{m}^3$ and are based on a unitized emission rate of 1 g/s per operating treatment pad.

TABLE 3-4
**COMPARISON OF ISCST RESULTS AND
OBSERVED PARTICULATE CONCENTRATIONS⁽¹⁾**

	Downwind Monitor 1		Downwind Monitor 2	
	ISCST Predicted Impact ⁽²⁾	Observed ⁽³⁾ Particulate Concentration	ISCST Predicted Impact ⁽²⁾	Observed ⁽³⁾ Particulate Concentration
1	1410.	14.1	313.	0.0
2	2003.	18.0	792.	133.4
3	1925.	76.8	768.	(4)
4	1758.	61.3	459.	48.2
5	1989.	89.6	576.	25.9
6	1472.	118.8	657.	14.0

(1) All concentrations in $\mu\text{g}/\text{m}^3$.
(2) ISCST predicted impacts based on a unitized emission rate of 1 g/s per operating treatment pad.
(3) Observed particulate concentrations have been blank corrected and corrected for upwind monitor observations.
(4) Monitor malfunctioned.

where:

ER is the total pollutant emission rate for the run,

OC is the observed concentration after upwind and blank corrections

PC is the predicted concentration listed in Table 3-3, and

NP is the number of treatment units operating during the run.

The calculated emission rates for each run are shown in Tables 3-5 through 3-10. Shown in these tables are the predicted impacts, based on the unitized emission rate, and measured pollutant concentrations. Only those pollutants with a measured concentration greater than the quantitation limit, after blank and upwind corrections, are listed. The resultant pollutant emission rates based on these data are also listed.

The emission rate estimates are summarized in Table 3-11. The pollutant emission rate for each run was conservatively based on the maximum of the two calculated emission rates for the two downwind monitors. To determine the average pollutant emission rate for the six runs, the average of the individual maximums was calculated. If a pollutant was not observed for a particular run, no emission rate was calculated for the run and it was not included in the calculation of the average estimated emission rate. The calculation and inclusion of emission rates based on quantitation limits would only result in a lower average emission rate. Therefore, the method utilized in the present report for calculating emission rates represents a very conservative approach.

The following discussion compares the model predictions at each downwind monitor with the observed concentrations. For run #1, ISCST calculated a higher concentration at the SED monitor. Of the seven pollutants whose upwind and blank corrected concentrations were above detectable limits, three pollutants showed higher concentrations at the SED monitor. These pollutants were:

- Particulates,
- Lead,
- Benzene.

Three pollutants had higher measured concentrations at the SWD monitor. These pollutants were:

- RDX,
- Aluminum,
- Toluene.

TABLE 3-5
CALCULATION OF EMISSION RATES FOR RUN #1
BASED ON THE VECTOR AVERAGE WIND DIRECTION

Pollutant	Conc. (a) at SED Monitor (ug/m3)	Modeled Conc at SED (ug/m3)	Calc. Emission Rate (g/sec)	Conc. (a) at SWD Monitor (ug/m3)	Modeled Conc at SWD (ug/m3)	Calc. Emission Rate (g/sec)
Particulates	14.090	1409.73	6.00E-02	0.029	312.98	5.56E-04
RDX	0.000	1409.73	0.00E+00	0.217	312.98	4.16E-03
Aluminum	0.042	1409.73	1.79E-04	0.362	312.98	6.94E-03
Barium	0.000	1409.73	0.00E+00	0.000	312.98	0.00E+00
Chromium	0.001	1409.73	4.26E-06	0.001	312.98	1.92E-05
Copper	0.000	1409.73	0.00E+00	0.000	312.98	0.00E+00
Lead	0.006	1409.73	2.55E-05	0.000	312.98	0.00E+00
Zinc	0.000	1409.73	0.00E+00	0.000	312.98	0.00E+00
Benzene	1.570	1409.73	6.68E-03	0.210	312.98	4.03E-03
Toluene	0.514	1409.73	2.19E-03	2.703	312.98	5.18E-02
Ethylbenzene	0.000	1409.73	0.00E+00	0.000	312.98	0.00E+00

(a) Upwind and blank corrected

TABLE 3-6
CALCULATION OF EMISSION RATES FOR RUN #2
BASED ON THE VECTOR AVERAGE WIND DIRECTION

Pollutant	Conc. (a) at NED Monitor (ug/m3)	Modeled Conc at NED (ug/m3)	Calc. Emission Rate (g/sec)	Conc. (a) at NWD Monitor (ug/m3)	Calc. Conc at NWD (ug/m3)	Actual Emission Rate (g/sec)
Particulates	17.986	2003.45	5.39E-02	133.352	791.69	1.01E+00
RDX	0.199	2003.45	5.96E-04	0.143	791.69	1.08E-03
Aluminum	0.040	2003.45	1.20E-04	0.983	791.69	7.45E-03
Barium	0.052	2003.45	1.56E-04	0.028	791.69	2.12E-04
Chromium	0.002	2003.45	5.99E-06	0.080	791.69	6.06E-04
Copper	0.030	2003.45	8.98E-05	0.135	791.69	1.02E-03
Lead	0.000	2003.45	0.00E+00	0.026	791.69	1.97E-04
Zinc	0.108	2003.45	3.23E-04	0.201	791.69	1.52E-03
Benzene	0.225	2003.45	6.74E-04	0.000	791.69	0.00E+00
Toluene	0.027	2003.45	8.09E-05	0.000	791.69	0.00E+00

(a) Upwind and blank corrected

TABLE 3-7

CALCULATION OF EMISSION RATES FOR RUN #3
BASED ON THE VECTOR AVERAGE WIND DIRECTION

Pollutant	Conc. (a) at NED Monitor (ug/m3)	Modeled Conc at NED (ug/m3)	Calc. Emission Rate (g/sec)	Conc. (a) at NWD Monitor (ug/m3)	Modeled Conc at NWD (ug/m3)	Calc. Emission Rate (g/sec)
Particulates	ND	768.17	0.00E+00	76.810	1925.41	2.39E-01
Aluminum	ND	768.17	0.00E+00	0.326	1925.41	1.02E-03
Barium	ND	768.17	0.00E+00	0.015	1925.41	4.67E-05
Chromium	ND	768.17	0.00E+00	0.013	1925.41	4.05E-05
Copper	ND	768.17	0.00E+00	0.103	1925.41	3.21E-04
Zinc	ND	768.17	0.00E+00	0.086	1925.41	2.68E-04
Benzene	0.000	768.17	0.00E+00	0.000	1925.41	0.00E+00
Toluene	0.000	768.17	0.00E+00	0.000	1925.41	0.00E+00
Total Xylenes	0.000	768.17	0.00E+00	0.000	1925.41	0.00E+00
2,4 Dinitrotoluene	0.000	768.17	0.00E+00	0.000	1925.41	0.00E+00
2,6 Dinitrotoluene	0.007	768.17	5.47E-05	0.000	1925.41	0.00E+00
2,4,6 Trinitrotoluene	0.000	768.17	0.00E+00	0.000	1925.41	0.00E+00

Upwind and blank corrected

ND: The monitors for these pollutants did not operate properly during testing.

TABLE 3-8

**CALCULATION OF EMISSION RATES FOR RUN #4
BASED ON THE VECTOR AVERAGE WIND DIRECTION**

Pollutant	Conc. (a) at NED Monitor (ug/m3)	Modeled Conc at NED (ug/m3)	Calc. Emission Rate (g/sec)	Conc. (a) at NWD Monitor (ug/m3)	Modeled Conc at NWD (ug/m3)	Calc. Emission Rate (g/sec)
Particulates	48.205	458.84	6.30E-01	61.259	1758.09	2.09E-01
Aluminum	0.294	458.84	3.84E-03	0.113	1758.09	3.86E-04
Barium	0.000	458.84	0.00E+00	0.079	1758.09	2.70E-04
Cadmium	0.000	458.84	0.00E+00	0.014	1758.09	4.78E-05
Copper	0.330	458.84	4.32E-03	0.083	1758.09	2.83E-04
Lead	0.028	458.84	3.66E-04	0.007	1758.09	2.39E-05
Zinc	0.176	458.84	2.30E-03	0.473	1758.09	1.61E-03
Benzene	0.080	458.84	1.05E-03	0.000	1758.09	0.00E+00
Toluene	0.000	458.84	0.00E+00	0.000	1758.09	0.00E+00
2,6 Dinitrotoluene	0.203	458.84	2.65E-03	0.003	1758.09	1.02E-05
2,4 Dinitrotoluene	0.047	458.84	6.15E-04	0.000	1758.09	0.00E+00
2,4,6 Trinitrotoluene	0.359	458.84	4.69E-03	0.118	1758.09	4.03E-04

) Upwind and blank corrected

TABLE 3-9

**CALCULATION OF EMISSION RATES FOR RUN #5
BASED ON THE VECTOR AVERAGE WIND DIRECTION**

Pollutant	Conc. (a) at NED Monitor	Modeled Conc at NED	Calc. Emission Rate	Conc. (a) at NWD Monitor	Modeled Conc at NWD	Calc. Emission Rate
	(ug/m3)	(ug/m3)	(g/sec)	(ug/m3)	(ug/m3)	(g/sec)
Particulates	25.907	576.47	2.70E-01	89.625	1987.89	2.71E-01
Benzo(b)fluoranthenes	0.006	576.47	6.24E-05	0.011	1987.89	3.32E-05
Benzo(j)fluoranthenes	0.002	576.47	2.08E-05	0.005	1987.89	1.51E-05
Benzo(e)pyrene	0.010	576.47	1.04E-04	0.018	1987.89	5.43E-05
Benzo(a)pyrene	0.004	576.47	4.16E-05	0.010	1987.89	3.02E-05
Indeno(c,d)pyrene	0.006	576.47	6.24E-05	0.010	1987.89	3.02E-05
Aluminum	0.923	576.47	9.61E-03	1.404	1987.89	4.24E-03
Antimony	0.083	576.47	8.64E-04	0.199	1987.89	6.01E-04
Barium	0.143	576.47	1.49E-03	0.202	1987.89	6.10E-04
Cadmium	0.003	576.47	3.12E-05	0.006	1987.89	1.81E-05
Copper	0.035	576.47	3.64E-04	0.137	1987.89	4.14E-04
Lead	2.549	576.47	2.65E-02	5.605	1987.89	1.69E-02
Zinc	0.164	576.47	1.71E-03	0.149	1987.89	4.50E-04
Benzene	1.276	576.47	1.33E-02	6.384	1987.89	1.93E-02
Toluene	0.336	576.47	3.50E-03	1.380	1987.89	4.17E-03
Ethylbenzene	0.000	576.47	0.00E+00	0.515	1987.89	1.55E-03

(a) Upwind and blank corrected

TABLE 3-10

**CALCULATION OF EMISSION RATES FOR RUN #6
BASED ON THE VECTOR AVERAGE WIND DIRECTION**

Pollutant	Conc. (a) at SED Monitor (ug/m3)	Modeled Conc at SED (ug/m3)	Calc. Emission Rate (g/sec)	Conc. (a) at SWD Monitor (ug/m3)	Modeled Conc at SWD (ug/m3)	Calc. Emission Rate (g/sec)
Particulates	118.797	1471.61	4.84E-01	14.043	656.55	1.28E-01
Benzo(b)fluoranthenes	0.011	1471.61	4.48E-05	0.004	656.55	3.66E-05
Benzo(j)fluoranthenes	0.007	1471.61	2.85E-05	0.002	656.55	1.83E-05
Benzo(e)pyrene	0.023	1471.61	9.38E-05	0.008	656.55	7.31E-05
Benzo(a)pyrene	0.016	1471.61	6.52E-05	0.005	656.55	4.57E-05
Indeno(c,d)pyrene	0.014	1471.61	5.71E-05	0.004	656.55	3.66E-05
Coronene	0.005	1471.61	2.04E-05	0.000	656.55	0.00E+00
Aluminum	3.575	1471.61	1.46E-02	1.233	656.55	1.13E-02
Antimony	0.121	1471.61	4.93E-04	0.054	656.55	4.93E-04
Barium	0.175	1471.61	7.14E-04	0.064	656.55	5.85E-04
Cadmium	0.038	1471.61	1.55E-04	0.009	656.55	8.22E-05
Chromium	0.060	1471.61	2.45E-04	0.000	656.55	0.00E+00
Copper	1.217	1471.61	4.96E-03	0.331	656.55	3.02E-03
Lead	4.096	1471.61	1.67E-02	1.863	656.55	1.70E-02
Zinc	0.157	1471.61	6.40E-04	0.000	656.55	0.00E+00
Benzene	3.840	1471.61	1.57E-02	3.942	656.55	3.60E-02
Toluene	0.035	1471.61	1.43E-04	0.389	656.55	3.55E-03
Ethylbenzene	0.012	1471.61	4.89E-05	0.016	656.55	1.46E-04
Total Xylenes	0.012	1471.61	4.89E-05	0.129	656.55	1.18E-03

(a) Upwind and blank corrected

TABLE 3-11
SUMMARY of CALCULATED EMISSION RATES
FOR THE GSX FACILITY

Pollutants	Run #1 (g/sec)	Run #2 (g/sec)	Run #3 (g/sec)	Run #4 (g/sec)	Run #5 (g/sec)	Run #6 (g/sec)	Average (g/sec)
Barium	0.00E+00	2.00E-04	0.00E+00	3.00E-04	1.50E-03	7.00E-04	6.75E-04
Cadmium	0.00E+00	0.00E+00	0.00E+00	4.78E-05	3.12E-05	2.00E-04	9.30E-05
Chromium	1.92E-05	6.00E-04	4.05E-05	0.00E+00	0.00E+00	2.00E-04	2.15E-04
Lead	0.00E+00	2.00E-04	0.00E+00	4.00E-04	2.65E-02	1.70E-02	1.10E-02
Nickel	2.60E-03	1.00E-03	4.00E-04	1.80E-03	1.40E-03	1.20E-03	1.40E-03
Antimony	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E-04	5.00E-04	7.00E-04
Zinc	0.00E+00	1.50E-03	3.00E-04	2.30E-03	1.70E-03	6.00E-04	1.28E-03
CPAH's	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-04	2.00E-04	2.00E-04
NCPAH'S	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-04	1.00E-04
RDX	4.20E-03	1.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-03
DNT	0.00E+00	0.00E+00	5.47E-05	3.30E-03	0.00E+00	0.00E+00	1.68E-03
TNT	0.00E+00	0.00E+00	0.00E+00	4.70E-03	0.00E+00	0.00E+00	4.70E-03
Benzene	6.70E-03	7.00E-04	0.00E+00	1.00E-03	1.93E-02	3.60E-02	1.27E-02
Toluene	5.18E-02	1.00E-04	0.00E+00	0.00E+00	4.20E-03	3.60E-03	1.49E-02
Methylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-03	1.00E-04	8.50E-04
Xylenes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-03	1.20E-03

NOTES

The emission rate for each pollutant (for each run) is the higher of two calculated rates (one calculated rate for each downwind monitor).

The average emission rate for each pollutant is the mean of the quantitative values (i.e. zero emission rates not included in the averaging).

One pollutant, Chromium, had an equal concentration at both monitors.

For run #2, ISCST calculated a higher concentration at the NED monitor. Of the ten pollutants whose upwind and blank corrected concentrations were above quantitation limits, four pollutants showed higher concentrations at the NED monitor. These pollutants were:

- RDX,
- Barium,
- Benzene,
- Toluene.

Six pollutants had higher measured concentrations at the NWD monitor. These pollutants were:

- Particulates,
- Aluminum,
- Chromium,
- Copper,
- Lead,
- Zinc.

For run #3, ISCST calculated a higher concentration at the NWD monitor. Quantitative data were available from the NWD monitor to facilitate the development of emission rates. Pollutant concentrations were not available for metals, particulates, or PAH's at the NED monitor due to a power failure at these monitors, and there were no detectable concentrations of VOC's or TNT. There was a trace amount of DNT detected at the NED monitor.

For run #4, ISCST calculated a higher concentration at the NWD monitor. Of the eleven pollutants whose upwind and blank corrected concentrations were above quantitation limits, four pollutants showed higher concentrations at the NWD monitor. These pollutants were:

- Particulates,
- Barium,
- Cadmium,
- Zinc.

Seven pollutants had higher measured concentrations at the NED monitor. These pollutants were:

- Aluminum,
- Copper,
- Lead,
- Benzene,
- 2,6 DNT,
- 2,4 DNT,
- TNT.

For run #5, ISCST calculated a higher concentration at the NWD monitor. Of the sixteen pollutants whose upwind and blank corrected concentrations were above quantitation limits, fifteen pollutants showed higher concentrations at the NWD monitor. The only pollutant that showed higher concentrations at the NED monitor was Zinc.

For run #6, ISCST calculated a higher concentration at the SED monitor. Of the nineteen pollutants whose upwind and blank corrected concentrations were above quantitation limits, fifteen pollutants showed higher concentrations at the SED monitor. The five pollutants that showed higher concentrations at the SWD monitor were:

- Benzene,
- Toluene,
- Ethylbenzene,
- Total Xylenes.

3.4 ISCLT Modeling Results

The results of the ISCLT model analysis are shown in Table 3-12. The ISCLT model was used to estimate maximum annual ground level impacts for use in the health risk assessment. Shown in this table are the maximum predicted concentrations for each model year, based on a facility emission rate of 1 g/s. The maximum predicted concentration was $3.3 \mu\text{g}/\text{m}^3$ and occurred with the 1974 STAR distribution. The lowest annual impact was $2.36 \mu\text{g}/\text{m}^3$ which occurred with the 1976 STAR distribution. Average maximum annual impact for the five years was $2.65 \mu\text{g}/\text{m}^3$. Note that these impacts represent the impact occurring during daylight hours only. The impact from facility operations during nighttime hours is zero.

TABLE 3-12
Summary of ISCLT Model Results

Model Year	Maximum Predicted Impact ⁽¹⁾ ($\mu\text{g}/\text{m}^3$)	Receptor Location ⁽²⁾	
		Direction (deg)	Distance (m)
1972	2.45	360	713
1973	2.45	360	713
1974	3.30	360	713
1975	2.71	360	713
1976	2.36	360	713

(1) Maximum predicted impact is based on a daytime STAR distribution. Stability classes occurring at night were eliminated and the STAR distribution renormalized to 1.

(2) Locations are relative to the center of treatment site B as shown in Figure 1-1 and 3-6.

The ISCLT model results show that the maximum predicted impacts occur due north of the facility at the facility fenceline. Predicted concentrations decrease with increasing distance and at 3 km from the facility are less than 10% of the maximum predicted concentration.

3.5 References

- Auer, A.H., Jr. 1978. Correlation of Land Use and Cover with Meteorological Anomalies. *Journal of Applied Meteorology*, 17:636-643.
- EPA, 1987a. Guideline on Air Quality Models (Revised). EPA 450/2-78-027R, U.S. Environmental Protection Agency, Research Triangle Park, NC, 27711.
- EPA, 1987b. Industrial Source Complex (ISC) Dispersion Model. EPA 450/2-88-002a, U.S. Environmental Protection Agency, Research Triangle Park, NC, 27711.
- Hanna, S., G. Briggs, and R. Hosker, Jr., 1982. Handbook on Atmospheric Dispersion. U.S. Department of Energy, 1982.

4.0 HEALTH RISK ASSESSMENT

4.1 Introduction

An inhalation health risk assessment was performed for the R&D Thermal Treatment facility according to ENSR Document No. 3246-001-500 to evaluate the potential human health effects from the emissions from the facility. The health risk assessment approach provides an estimate of the inhalation health risks for residents in the area of the maximum estimated annual average ground level concentration (GLC). Since the R&D facility is located in a wooded, rural area in central Louisiana, the inhalation pathway is anticipated to be the primary route of exposure for the population surrounding the facility. The health risk assessment provided below is based on the maximally exposed individual (MEI). In keeping with the conservative nature of the present health risk assessment, the following conservative assumptions were utilized in this effort.

- All chemicals were assumed to have an identical bioavailability as in the toxicological and/or epidemiological studies utilized to develop the reference doses (RfDs) and cancer potency factors (CPFs),
- Exposures were estimated for a 70 year facility operation, even though the expected facility lifespan is less than 70 years,
- Maximum emission rates for waste treatment were utilized to estimate GLCs for each chemical,
- For Cr, 10% of all emissions were assumed to be as CrVI.

4.2 Source Emissions

The chemical characteristics of the emissions were determined during a source testing program conducted at the R&D facility during January 1991. The target compound emission rates (Table 4-1) represent the highest estimated releases from the two downwind monitors resulting from the thermal treatment of each of three separate waste streams over two runs. Thus all emission rates shown in Table 4-1 represent the highest estimated emission rate for the target chemicals per thermal treatment run. The emission testing was conducted according to ENSR Document No. 3246-001-200, which was approved by EPA on December 11, 1990.

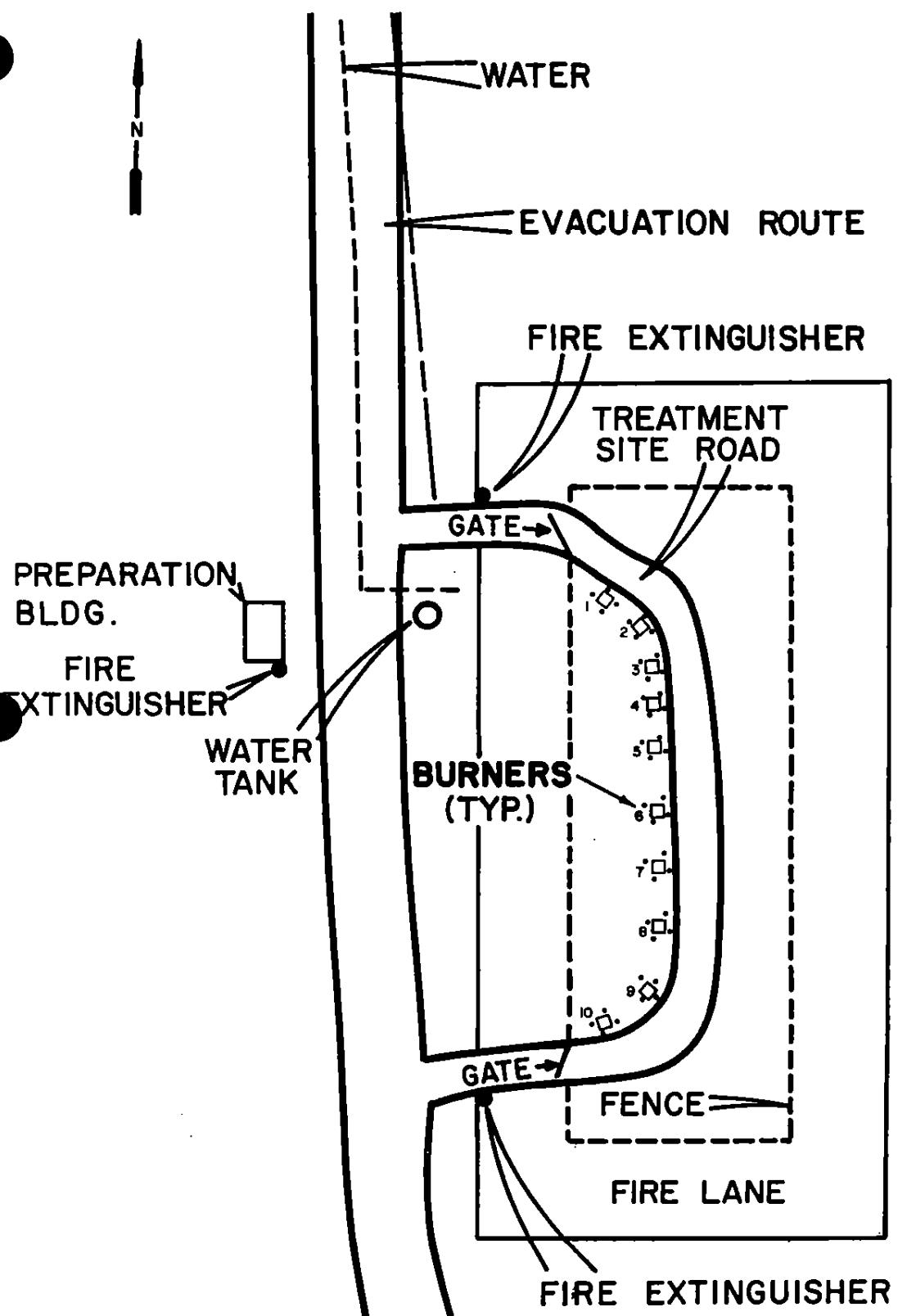


FIGURE 2

SAMPLE LOCATIONS
SAMPLE LOCATIONS ARE APPROXIMATELY 2 FEET FROM EDGE OF
BURNER PAD IN AN APPROXIMATE NORTH, SOUTH, EAST AND
WEST DIRECTION.

TABLE 4-1
SUMMARY of CALCULATED EMISSION RATES
FOR THE GSX FACILITY

Pollutants	Run #1 (g/sec)	Run #2 (g/sec)	Run #3 (g/sec)	Run #4 (g/sec)	Run #5 (g/sec)	Run #6 (g/sec)	Average (g/sec)
Barium	0.00E+00	2.00E-04	0.00E+00	3.00E-04	1.50E-03	7.00E-04	6.75E-04
Cadmium	0.00E+00	0.00E+00	0.00E+00	4.78E-05	3.12E-05	2.00E-04	9.30E-05
Chromium	1.92E-05	6.00E-04	4.05E-05	0.00E+00	0.00E+00	2.00E-04	2.15E-04
Lead	0.00E+00	2.00E-04	0.00E+00	4.00E-04	2.65E-02	1.70E-02	1.10E-02
Nickel	2.80E-03	1.00E-03	4.00E-04	1.80E-03	1.40E-03	1.20E-03	1.40E-03
Antimony	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E-04	5.00E-04	7.00E-04
Zinc	0.00E+00	1.50E-03	3.00E-04	2.30E-03	1.70E-03	6.00E-04	1.28E-03
CPAH's	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-04	2.00E-04	2.00E-04
NCPAH's	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-04	1.00E-04
RDX	4.20E-03	1.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-03
DNT	0.00E+00	0.00E+00	5.47E-05	3.30E-03	0.00E+00	0.00E+00	1.68E-03
TNT	0.00E+00	0.00E+00	0.00E+00	4.70E-03	0.00E+00	0.00E+00	4.70E-03
Benzene	6.70E-03	7.00E-04	0.00E+00	1.00E-03	1.93E-02	3.60E-02	1.27E-02
Toluene	5.18E-02	1.00E-04	0.00E+00	0.00E+00	4.20E-03	3.60E-03	1.49E-02
Methylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-03	1.00E-04	8.50E-04
Styrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-03	1.20E-03

NOTES

The emission rate for each pollutant (for each run) is the higher of two calculated rates (one calculated rate for each downwind monitor).

The average emission rate for each pollutant is the mean of the quantitative values (i.e. zero emission rates not included in the averaging).

Table 4-2

Estimated Inhalation Risks for the R&D Thermal Treatment Facility\$

Pollutant	Emission Rate (Lb/hr)	Emission Rate (g/s)	Maximum Annual Impact (mg/m ³)	RID (mg/kg/day)	CPF (mg/kg/day)-1	Estimated Dose (mg/kg/day)	Hazard Index	Excess Cancer Risk
Ba	5.3582E-03	6.7500E-04	2.2275E-06	0.07000	NA	0.0000002100	0.0000030003	0
Cd	7.3823E-04	9.3000E-05	3.0690E-07	0.00100	6.100	0.0000000289	0.00000289363	0.00000001765
Cr ^a	1.7067E-03	2.1500E-04	7.0950E-07	1.00000	41.000	0.0000000669	0.0000000602	0.00000002743
Pb [*]	8.7318E-02	1.1000E-02	3.6300E-05	0.00010	NA	0.0000034226	0.0342257.43	0
Ni	1.1113E-02	1.4000E-03	4.6200E-06	0.02000	0.840	0.0000004356	0.00000217800	0.0000000366
Sb	5.5566E-03	7.0000E-04	2.3100E-06	0.00040	NA	0.0000002178	0.0005445000	0
CPAHs	1.5876E-03	2.0000E-04	6.6000E-07	NA	2.200	0.0000000622	NA	0.0000001369
NCPAHs	7.9380E-04	1.0000E-04	3.3000E-07	0.00400	NA	0.0000000311	0.0000077786	0
RDX	2.1036E-02	2.6500E-03	8.7450E-06	0.00300	0.110	0.0000001999	0.0000666286	0.0000000022
DNT	1.3336E-02	1.6800E-03	5.5440E-06	NA	0.680	0.0000002693	NA	0.0000001631
TNT	3.7309E-02	4.7000E-03	1.5510E-05	0.00050	0.030	0.0000007533	0.0015066857	0.0000000226
Benzene	1.0081E-01	1.2700E-02	4.1910E-05	NA	0.029	0.0000039515	NA	0.0000001146
Toluene	1.1828E-01	1.4900E-02	4.9170E-05	0.00300	NA	0.0000046360	0.0015453429	0
Ethylbenzene	6.7473E-03	8.5000E-04	2.8050E-06	0.10000	NA	0.0000002645	0.0000002647	0
Xylenes	9.5256E-03	1.2000E-03	3.9600E-06	2.00000	NA	0.0000003734	0.0000001867	0

NOTES:

\$ - Reference dose and cancer potency factor information from HEAST Third Quarter 1990, and an IRIS search completed at the end February 1991

& - For Cr, 10% of emissions are assumed to be in the hexavalent form.

* - Based on the Pb NAAQS of 1.5 ug/m³ on a 90-day average.

5.0 SOIL SAMPLING DATA

As outlined in Section 7.0 of the "Final Source Characterization Plan for the R&D Thermal Treatment System", forty-two (42) surface soil samples were collected at the R&D Facility on January 9, 1991 to be analyzed for extractable explosives, Appendix VIII total metals and at least ten (10) samples for Appendix VIII organics. Of these 42 samples, four (4) samples were collected from each of the ten (10) burners (see Figures 5-1 and 5-2) along with two (2) background samples. The explosives samples were forwarded to Environmental Science and Engineering, Inc. of Gainesville, FL for analysis; whereas, the samples for the Appendix VIII parameters were forwarded to Davis & Floyd, Inc. of Greenwood, SC. Copies of all the analytical results are provided in Attachment A.

Extractable Explosives

The analytical results for the explosives indicate low levels of HMX and RDX, ranging from 0.758 to 3.45 ug/g for HMX and from 0.674 to 13.3 ug/g for RDX, at all burners presently being used (1, 3, 5, 7, 8, and 10) and in the north sample collected at burner #4.

Appendix VIII - Organics

As outlined in the source characterization plan, five (5) samples from alternate burner locations were initially screened for Appendix VIII organics. These analysis yielded the following results:

<u>Sample ID#</u>	<u>Analytical Results</u>
B1N	None Detected
B3N	None Detected
B5N	Trichlorofluoromethane - 43 ug/kg (1st run) [*] Acetone - 71 ug/kg (2nd run) ^{**}
B7N	None Detected
B9N	Acetone - 24 ug/kg (1st run) ^{**} Acetone - 71 ug/kg (2nd run) ^{**}

* Not confirmed in the 2nd run.

** Possible laboratory cross contaminant.

Based on these results, a screening list was to be developed to be used in analyzing the remaining samples. However, a sufficient target list could not be developed due to the limited results available and the possibility of laboratory cross contamination. Therefore, after discussing

this issue with EPA Region VI personnel, it was proposed that ten (10) additional samples, one randomly selected sample from each of the 10 burner pots, be analyzed for the volatile organic parameters identified in Attachment B. This list originated from the Hazardous Substance List. For any significant detection of volatile organics observed during this phase of analytical work, the remaining samples would then be analyzed for these parameters. If volatile organics were not detected, then no additional analytical work would be performed.

The second screening for the volatile organics yielded the following results:

<u>Sample ID#</u>	<u>Analytical Results</u>
B1W	Methylene Chloride - 3 ug/kg ^J Acetone - 17 ug/kg ^B
B2E	Methylene Chloride - 2 ug/kg ^J Acetone - 14 ug/kg ^B
B3N	Methylene Chloride - 4 ug/kg ^J Acetone - 18 ug/kg ^B
B4W	Methylene Chloride - 3 ug/kg ^J Acetone - 23 ug/kg ^B
B5E	Methylene Chloride - 3 ug/kg ^J Acetone - 31 ug/kg ^B
B6W	Methylene Chloride - 3 ug/kg ^J Acetone - 17 ug/kg ^B
B7E	Chloromethane - 6 ug/kg Methylene Chloride - 4 ug/kg ^J Acetone - 34 ug/kg ^B
B8W	Methylene Chloride - 4 ug/kg ^J Acetone - 24 ug/kg ^B
B9W	Methylene Chloride - 4 ug/kg ^J Acetone - 24 ug/kg ^B
B10S	Methylene Chloride - 5 ug/kg ^B Acetone - 19 ug/kg

J = estimate below the required detection limit

B = compound detected in method blank (Acetone - 9 ug/kg; Methylene Chloride - 1 ug/kg)

Since the organics present appear to laboratory related and not directly attributable to the site activities, additional organic analysis were not conducted.

Appendix VIII - Total Metals

For the metals analysis, results above background levels were reported for arsenic, barium, chromium, copper, lead, nickel, vanadium and zinc.

Conclusion

The analytical results from the surface soil samples indicate the presence of some metals and explosives above background levels in the soils around the existing concrete burner pads. As outlined in the Part B Application for the facility, once the new treatment area is constructed, closure of the existing concrete burner pads will be initiated. The Closure Plan (Chapter 35) requires that four (4) soil samples be collected to a depth of six (6) inches around each of the ten (10) concrete burner pads to determine if contamination of the surrounding soils has occurred. Therefore, it is the intention of the facility, to forego additional sampling until closure of these burner pads is initiated. The additional sampling to be conducted at the time of closure will fully assess any soil contamination that may exist and will determine the proper method for disposal of this material.

As noted in Chapter 2 of the present report, many target chemicals were found below the method quantitation limits. For the purposes of the present analysis ENSR utilized the mean emission rates for those pollutants that yielded measurable results above the quantitation limits. This approach is more conservative than averaging method quantitation limit values with quantitative results to develop the mass emission rates. For example, only runs #5 and #6 produced quantitative emission rates for carcinogenic PAHs. For the purposes of the present HRA, the emission rates for the entire facility are based on the average value of these two runs.

4.3 Summaries of the Toxicological Effects of the Target Chemicals

Virtually all of information for the specific chemicals discussed below was obtained from IRIS during late February 1991.

Aluminum

Aluminum is the third most abundant element in the earth's crust and represents a major component of airborne particulate matter resulting from wind blown soil particles and other fugitive emission sources. Aluminum is not presently included in the IRIS database and the HEAST (3rd Quarter, 1990) document indicates that there is insufficient data to develop a RfD for this substance. High dosages of aluminum can cause phosphorus imbalances in test animals. There are also some unconfirmed hypotheses that elevated aluminum exposures can cause neurological disorders. Because of the low toxicity of aluminum and due to EPA's observation that there is insufficient data to develop a health criterion, this substance will not be included in the overall quantitative health risk assessment.

Antimony

Antimony is infrequently measured in air sampling and studies, and in urban areas, municipal waste incineration is thought to be the primary source of this metal in the atmosphere. Very little data is available regarding the toxicity of antimony. According to EPA, there are no data available to evaluate the carcinogenicity of antimony. An oral RfD has been developed based on a dietary study with rats and the NOEL was estimated to be 0.35 mg/kg/day. EPA used an UF=1000, based on interspecies differences, and calculated an RfD of 0.0004 mg/kg/day. EPA has a low confidence in the antimony oral RfD. The IRIS database also indicated that high level, occupational exposures to antimony are linked to myocardial effects and EPA estimated that a NOEL for inhalation based on these studies is 0.5 mg/m³. This NOEL is approximately equivalent to 0.003 mg/kg/day.

Barium

Two recent studies regarding barium have caused EPA to re-estimate an oral RfD for this substance. Both studies are based on human data, and thus tend to be more reliable for establishing a NOAEL for this chemical. The primary concern regarding elevated exposures to barium is hypertension, which places adult males at the greatest risk. For example, occupational health studies have linked elevated barium exposures with increase incidence of hypertension. An epidemiological study of drinking water exposures and cardiovascular mortality provides the basis for the oral RfD calculated by EPA. The NOAEL from this epidemiological study was 7.3 mg/l or 0.2 mg/kg/day. A study where human subjects were exposed to barium in drinking water produced a NOAEL of 10 mg/l or 0.21 mg/kg/day. The target health effect in this later study was increased blood pressure. EPA assigned an UF=3 and calculated an oral RfD of 0.07 mg/kg/day. EPA has a medium confidence level in this RfD. At present, a suitable animal model has not been identified to evaluate barium toxicity.

Benzene

Benzene is a ubiquitous air contaminant in most urbanized portions of the US. Based on epidemiological studies, benzene is classified as a leukemogen. This organic chemical is considered by EPA to an A carcinogen; that is, it has been linked, in epidemiological studies as to non-lymphatic leukemia. The epidemiological studies included workers from shoe, rubber products, and chemical manufacturing and consistently provide a link between benzene exposures and leukemia incidence. Additional supporting data is available from animal studies that links benzene exposures with increased neoplasia incidence in target populations. Both gavage and inhalation studies with benzene in mice and rats have been shown to be linked to increased cancer incidence, including, leukemias/lymphomas. In developing their cancer potency factor, EPA used the data from three epidemiological studies. The quality of the human exposure data is highly variable across the three epidemiological studies and there is some disagreement amongst the authors regarding worker exposure levels. According to EPA, however, unit risk estimates for inhalation exposures based on various combinations of the epidemiological data are quite similar.

Cadmium

Based on human studies regarding NOAELs for proteinuria, U.S. EPA has established drinking water oral RfDs (5e-4 mg/kg/day) and food oral RfDs (1e-3 mg/kg/day). These levels are based on a exposure model developed by the agency and the observation that the highest NOAEL for proteinuria is 200 µg Cd per gm wet weight of renal cortex tissue. An inhalation Rfd has not been developed for cadmium.

This trace element is considered by U.S. EPA to be a B1 carcinogen; that is it is a probable human carcinogen by the inhalation route based on animal exposure studies. Elevated lung cancer incidences have been found in cadmium smelter workers. Cadmium has been linked to excess prostate cancers for workers exposed to cadmium dusts and/or fumes. Most available animal study results are negative for cadmium exposures. A recent Japanese toxicological study provided a direct positive association with cadmium chloride exposures and lung cancer incidence in Wistar rats. The cancer potency value developed for cadmium by U.S. EPA was based on human epidemiological studies of cadmium smelter workers.

Chromium

The potency of chromium has been shown to vary according to its oxidation state, i.e., whether chromium is in the trivalent or hexavalent form. Trivalent chromium is an essential nutrient and there is some evidence that hexavalent chromium is reduced to trivalent chromium *In vivo*. An oral RfD for soluble forms of hexavalent chromium has been developed by U.S. EPA based on a study of potassium chromate exposures in Sprague-Dawley rats. The oral RfD developed by U.S. EPA is 5e-3 mg/kg/day. At the present time, an inhalation RfD has not been developed by U.S. EPA.

This trace element is considered by U.S. EPA to be a class A carcinogen; that is it has been linked, in epidemiological studies, to various cancers in human populations exposed via the inhalation route. These epidemiological studies provide the main link between hexavalent chromium exposures and lung cancer incidence. Studies of workers associated with chromate production have established an association between chromium exposure and lung cancer. Additional supporting information is available from chrome pigment production and lung cancer incidence in exposed workers. However, most of the epidemiological studies failed to differentiate between hexavalent and trivalent chromium exposures. Hexavalent chromium exposures have also been shown to be linked to cancer incidences in a number of animal studies utilizing various rat and mice strains. However, animal inhalation exposures have failed to produce lung tumors. There are no human or animal studies that link increased cancer incidence with oral exposures to hexavalent chromium. The cancer potency factor developed by U.S. EPA for chromium was based on a human epidemiological study of chromate workers.

Copper

Very little health effects information is available regarding the toxicity of copper. Copper is an essential element and humans absorb copper poorly through the gastrointestinal tract. Based on the current drinking water standard of 1.3 mg/l an oral RfD can be estimated at 0.033 mg/kg/day, assuming a 70 kg person drinks 2 lpd. This RfD value is close to the National

Academy of Sciences recommended daily intake of copper is 0.042 mg/kg/day for a 70 kg adult. Thus there is high level of uncertainty for the copper RfD.

Dinitrotoluenes

Both 2,4-dinitrotoluene and 2,6-dinitrotoluene (DNTs) are important components in ammunition, propellants and black powder. EPA classifies DNTs as a B2 carcinogen; that is, it is a probable human carcinogen based animal exposure studies. Supporting data include multiple benign and malignant tumors at a number of sites, particularly the liver, in rats and malignant renal tumors in mice. All animal exposure studies for DNTs are based on administering the chemical to the test animals through diet. Thus EPA has developed only an oral cancer potency factor for this substance. According to EPA, there are insufficient data to develop an oral RfD and/or an inhalation RfC for DNTs.

Ethylbenzene

Ethylbenzene is a common component of many petroleum products, particularly fuels such as gasoline. Like benzene, toluene and xylenes, ethylbenzene is a ubiquitous air contaminant in most urbanized portions of the U.S. EPA classifies ethylbenzene as a D carcinogen; that is, based on the data presently available it cannot be classified as to human carcinogenicity. An oral RfD has been developed by EPA for ethylbenzene based on a gavage study of rats. The No Observable Effect Level or NOEL was 97.1 mg/kg/day after conversion to an exposure on a 7 day per week basis. The NOEL is based on liver and kidney toxicity in the test animals. EPA assigned an UF=1000 based on the known different metabolic pathways for humans and rodents for aromatic hydrocarbons such as ethylbenzene and calculated an oral RfD of 0.1 mg/kg/day. According to IRIS data, EPA has a low level of confidence in the ethylbenzene oral RfD.

Lead

A tremendous amount of information is available regarding the chronic and subchronic effects of lead on human populations. Information available to U.S. EPA suggests that there may be virtually no threshold for lead exposures for children. In 1986, U.S. EPA compiled a vast amount of health effects data on lead for the Lead Criteria Document for the evaluation of the existing National Ambient Air Quality Standard (NAAQS) for this substance. The present NAAQS for lead is 1.5 $\mu\text{g}/\text{m}^3$ quarterly (90 day) average. U.S. EPA has developed an oral RfD for alkyl lead compounds, which are not likely to be an emission product from most combustion sources. Although to date U.S. EPA has not developed either inhalation or oral RfDs for inorganic lead,

- o a preliminary inhalation RfD could be developed based on the present NAAQS for lead. This inhalation RfD is presented in the risk characterization section of this report.

This trace element is considered by U.S. EPA to be a B2 carcinogen; that is it is a probable human carcinogen based on animal exposure studies. A number of epidemiological studies of lead-processing workers have been unequivocal. Lead salts (primarily acetates and phosphates) have been shown to be carcinogenic via oral, dietary and/or by injection exposures in over 10 animal studies. Lead has been shown to cause both renal and lung tumors in rats and mice. There are no inhalation toxicology studies investigating the impacts of lead exposures on cancer incidence in the target animals. Because of the current level of uncertainty regarding the carcinogenic potency of lead and various lead compounds, at the present time the U.S. EPA has not developed a cancer potency factor for this substance.

Nickel

The toxicity of nickel is a function of its chemical form. U.S. EPA has developed an oral RfD (2E-2 mg/kg/day) for a soluble nickel compound, NiSO₄, based on dietary exposures in rats. Nickel emissions from most combustion sources are likely to be in the insoluble oxide form. Thus utilization of an RfD based on soluble nickel compounds is likely to overestimate health effects from exposure to nickel oxide (NiO).

This substance is classified by U.S. EPA as a class A carcinogen. That is, it has been linked, in epidemiological studies, to various cancers in exposed human populations. Human epidemiological studies of the nickel refining industry have produced a positive association with nickel exposures and the incidence of lung and nasal tumors. Nickel refining dusts contain a number of different nickel compounds including the oxide, sulfate and subsulfide forms and trace amounts of other metal contaminants. It is unclear at the present time which of the various nickel compounds associated with nickel refining dusts are the most important in the induction of lung and nasal tumors in exposed human populations. This is an important concern considering that nickel emissions from most combustion sources are likely to be in the insoluble oxide form. Animal studies of some constituents of nickel refining dusts have produced mixed results. In this case, some studies have produced positive associations of nickel refining dusts and cancer incidences in the test animals, while others have produced negative results.

1-Nitropyrene

During efforts focusing on the mutagenic activity of diesel particulates, nitro-containing polycyclic aromatic hydrocarbons (N-PAHs) were identified as a major component of such biological action (Claxton, 1983). Since these efforts N-PAHs have been found in a wide variety of combustion

sources and have been shown to be an atmospheric reaction product of unsubstituted PAHs (Pitts, 1987). While hundreds of N-PAHs have been identified in combustion source samples, 1-nitropyrene represents the one of the most commonly reported N-PAH in ambient air studies (Zielinska et al., 1989). While 1-nitropyrene has been shown to cause rat mammary gland tumors in the laboratory (Hirose et al., 1984) and many N-PAHs have been shown to be potent direct-acting mutagens (Claxton, 1983), U.S. EPA has not established a RfD and/or a CPF for this chemical and this substance is not included in the IRIS database.

PAHs Included in IRIS

Benzo(a)pyrene

EPA concluded that benzo(a)pyrene is strongly carcinogenic based on available information. The EPA Human Health Assessment Group (HHAG, formerly CAG) has classified benzo(a)pyrene as a Class B2 carcinogen; that is, it is a probable human carcinogen based animal exposure studies. Benzo(a)pyrene is the most thoroughly studied of the PAH. Exposure to benzo(a)pyrene has been associated with lung, skin, and other tumors in animals. In addition, benzo(a)pyrene has been shown to be both a local and systemic carcinogen by oral, dermal, and intratracheal routes. It has also been shown to be a transplacental carcinogen and an initiator of skin carcinogenesis in mice. Few studies have adequately examined the carcinogenic effects of orally administered benzo(a)pyrene, but it has been shown to induce forestomach tumors in mice. The EPA HHAG estimated an oral cancer slope factor for benzo(a)pyrene (EPA, 1982) based on a quantitative analysis of the dose-response data presented in a diet study. In this study, male and female mice (CFW strain) were repeatedly fed benzo(a)pyrene in their diet. The carcinogenic endpoint was forestomach tumors. The slope factor is $11.5 \text{ (mg/kg/day)}^{-1}$. Numerous other studies similarly demonstrate that orally administered benzo(a)pyrene can cause gastric tumor in several strains of mice. Previous studies, however, did not utilize large numbers of animals or multiple dosage levels. Benzo(a)pyrene has been shown to cause distant site tumors when administered orally. This is consistent with the wide tissue distribution that has been observed in rodents following gastrointestinal absorption.

Dibenzo(a,h)anthracene

EPA has determined that it is very strongly carcinogenic based on the available information. The EPA HHAG has classified dibenzo(a,h)anthracene as a Class B2 carcinogen; that is, it is a probable human carcinogen based animal exposure studies. Dibenzo(a,h)anthracene has been tested for carcinogenicity in a number of test species employing various different routes of exposure with positive results being reported in the majority of studies. It increased the incidence of forestomach tumors, mammary tumors, and pulmonary tumors in mice that were

exposed by the oral route in numerous studies. Dibenzo(a,h)anthracene was also shown to be a complete carcinogen in mouse skin, and it is an initiator in the mouse-skin initiation-promotion assay. Injection site sarcomas have also been produced when dibenzo(a,h)anthracene was administered by subcutaneous or intramuscular injection in various studies. No cancer potency factors have been developed by EPA for this PAH.

Benzo(b)fluoranthene

EPA has determined that it is strongly carcinogenic based on the available information. The EPA HHAG has classified benzo(b)fluoranthene as a Class B2 carcinogen; that is, it is a probable human carcinogen based animal exposure studies. Benzo(b)fluoranthene has been shown to be a complete carcinogen in mouse skin and an initiator in the mouse-skin initiation-promotion assay. Local sarcomas have been produced when benzo(b)fluoranthene has been injected subcutaneously into mice. No cancer potency factors have been developed by EPA for this PAH.

Benzo(k)fluoranthene

EPA concluded that benzo(k)fluoranthene was not carcinogenic to experimental animals based on available evidence. The EPA HHAG has classified benzo(k)fluoranthene as Class D; that is, based on the data presently available zinc cannot be classified as to human carcinogenicity. Benzo(k)fluoranthene was tested for carcinogenicity in females in two strains of mice by skin application and few tumors resulted. In the mouse-skin initiation-promotion assay, it was active as an initiator. In one experiment in which benzo(k)fluoranthene was injected subcutaneously, injection site sarcomas resulted. Benzo(k)fluoranthene produced carcinomas of the lung in rats when injected into pulmonary tissue. No cancer potency factors have been developed by EPA for this PAH.

Indeno(1,2,3-cd)pyrene

EPA has concluded that it is carcinogenic based on an evaluation of the available data. The EPA HHAG has classified indeno(1,2,3-cd)pyrene as a Class C carcinogen; that is, it is a possible human carcinogen. Indeno(1,2,3-cd)pyrene is a complete carcinogen in mouse skin and is an initiator in the mouse-skin initiation-promotion assay. It also has been shown to cause injection site sarcomas in mice. No cancer potency factors have been developed by EPA for this PAH.

Phenol

Primary information available on the potential health effects from chronic exposures to phenol are based on gavage studies. EPA classifies phenol as a D carcinogen; that is, based on the data presently available phenol cannot be classified as to human carcinogenicity. There are some data that suggests that phenol may be a tumor promoter. A gavage study of pregnant CD rats produced a NOAEL for fetal development effects of 60 mg/kg/day. The major impact of phenol in this and others studies is on body weight. EPA calculated an oral RfD based on a UF=1000 of 0.6 mg/kg/day. EPA has a low level of confidence in this RfD.

RDX

The substance hexhydro-1,3,5-trinitro-1,3,5-triazine (RDX) is an important explosive used in ammunition, detonators, high explosives and oil well cutters. A well designed and executed, chronic RDX exposure study in Fischer 344 rats forms the basis for an oral RfD. The NOEL was 0.3 mg/kg/day and EPA assigned a UF=100, thus the oral RfD is 0.003 mg/kg/day. EPA classifies RDX as a C carcinogen; that is, it is a possible human carcinogen. Studies in female mice suggest that RDX exposures are associated with an increased incidence in of liver adenomas and carcinomas. The oral carcinogenic potency factor developed by EPA for RDX is based on the results from a recent USDOD (1984) study using B6C3F1 mice. No inhalation related toxicological data are available for RDX.

Selenium

Selenium is used in electronics, glass, pigment and rubber manufacturing. In addition, selenium has been shown to be an essential element in humans. An oral RfD (0.003 mg/kg/day) has been developed by EPA based on human exposures to selenious acid. However, according to the National Academy of Sciences the recommended safe and adequate dietary intake of selenium for a 70 kg adult is about 0.0029 mg/kg/day. Since the acceptable dietary intake value is similar to the oral RfD, the present RfD is inconsistent with existing health data. Thus the present RfD is unacceptable for the present analysis.

Toluene

Toluene is a common component of many petroleum products, particularly fuels such as gasoline. Like the benzene, ethylbenzene and xylenes, toluene is a ubiquitous air contaminant in most urbanized portions of the U.S. EPA classifies toluene as a D carcinogen; that is, based on the data presently available it cannot be classified as to human carcinogenicity. An oral RfD has been developed by EPA for toluene based on a gavage study of F344 rats. The No

Observable Effect Level or NOEL was 223 mg/kg/day after conversion to a exposures on a 7 day per week basis. The NOEL is based on liver and kidney weight changes in the test animals. EPA assigned an UF=1000 based on the known different metabolic pathways for humans and rodents for aromatic hydrocarbons such as toluene. According to IRIS data, EPA has a medium level of confidence in the toluene oral RfD. A chronic inhalation exposure study with F344 rats failed to produce an adverse effect, even at the highest dose level (NOAEL) of 300 ppm, 6 hours/day, 5 days/week for 24 months.

Trinitrotoluene

Trinitrotoluene (TNT) is an important explosive and is used as a component of high explosives. EPA classifies TNT as a C carcinogen; that is, it is a possible human carcinogen. The oral cancer potency factor developed by EPA is based on diet studies with F344 rats which resulted in an increase in urinary bladder papillomas and carcinomas in female rats. In the subchronic laboratory study selected by EPA for establishing and oral RfD, beagle dogs was the test animal and the Lowest Observable Adverse Effect Level (LOAEL) for TNT administered orally in a capsule was 0.5 mg/kg/day. The LOAEL is based on liver damage in the test animals. EPA assigned an UF= 1000 based primarily on animal-to-man and the LOAEL-to-NOEL extrapolations. Thus the oral RfD for TNT is 0.0005 mg/kg/day. According to IRIS data, EPA has a medium level of confidence in the TNT oral RfD.

Xylenes

Xylenes (o,m,p-xylenes) are a common component of many petroleum products, particularly fuels such as gasoline. Like the benzene, ethylbenzene and toluene, xylenes are a ubiquitous air contaminant in most urbanized portions of the U.S. EPA classifies xylenes as D carcinogens; that is, based on the data presently available they cannot be classified as to human carcinogenicity. An oral RfD has been developed by EPA for xylenes based on a gavage study of F344 rats. The No Observable Effect Level or NOEL was 179 mg/kg/day after conversion to an exposure on a 7 day per week basis. The NOEL is based on CNS toxicity in the test animals. EPA assigned an UF=100 based on the known different metabolic pathways for humans and rodents for aromatic hydrocarbons such as xylene. According to IRIS data, EPA has a medium level of confidence in the toluene oral RfD. A chronic inhalation exposure study with rats, guinea pigs, dogs, and monkeys produced a NOEL of 0.6 mg/kg/day.

Zinc

Zinc is an essential nutrient for humans and the National Academy of Sciences has recommended a daily zinc requirement for adults of 15mg/day or based on a 70 kg human, 0.21 mg/kg/day. EPA classifies zinc as a D carcinogen; that is, based on the data presently available zinc cannot be classified as to human carcinogenicity. An oral RfD has been developed by EPA for zinc of 0.2 mg/kg/day, although this RfD is currently being reviewed by the agency. Because there is apparently a wide margin of safety between normal dietary zinc exposures and adverse effects, and that the RfD is virtually identical to the recommended adult daily zinc requirement, the present RfD is inconsistent with existing health data. Thus the present RfD is unacceptable for the present analysis.

4.4 Exposure Assessment

The R&D facility is expected to operate less than 70 years, however a 70 year period of operation was utilized in the screening risk assessment to estimate maximum lifetime exposures. In addition, to determine the maximum exposure levels for the MEI the following assumptions were utilized to calculate the daily dose:

- All chemicals were assumed to be 100% bioavailable,
- 20 m³ of air was respired per day,
- A 70 kg person was assumed to be exposed to the modeled GLCs for 70 years,
- The GLC used in the analysis represented the maximum annual concentration as opposed to the 5 year average concentration.

To better estimate human exposures to airborne chemicals for the present HRA, annualized emissions were scaled to reflect the quantity of specific waste streams to be treated on a annual basis or the anticipated operation schedule for the R&D facility. For example, it is ENSR's understanding that the R&D facility will only operate 8 hr/day, 365 days/yr for a total of 2920 hr/yr. For RDX the scaling factor is 0.08, based on a maximum throughput of RDX of 40,000 lbs/yr and a facility capacity of 480,000 lbs/yr. For TNT and DNT the scaling factor is 0.17, based on a maximum throughput of TNT of 80,000 lbs/yr and a facility capacity of 480,000 lbs/yr. The scaling factor for contaminants measured from the thermal treatment of all three waste streams is (2920 Operational hours/8760 Actual hours) or 0.33.

4.5 Risk Characterization

For the present analysis, all RfDs and CPFs were taken from U.S. EPA "Health Effects Assessment Summary Tables (HEAST) - Third Quarter FY 1990, 7/90" or information contained in IRIS files during the latter portion of February 1991. Ten percent of all total Cr values were assumed to be in the form of hexavalent Cr. This approach is consistent with EPA's treatment of Cr emissions from hazardous waste incinerators (EPA, 1989; Technical Background Document: Control of Metals and HCl Emissions from Hazardous Waste Incinerators, Office of Solid Waste, 150 pp). In this document, EPA assumed that 10% of the Cr emissions from hazardous waste incinerators are in the hexavalent form. Assuming that 10% of the emitted Cr is hexavalent Cr for hazardous waste incinerators is more conservative than what the agency considered appropriate for other combustion sources. For example, a recent EPA document "Technical Support Document for the Incineration of Sewage Sludge" indicates that the agency assumed for regulation development that reasonable worst case sewage sludge incineration emissions for hexavalent Cr are 1% of the total Cr emissions. Further EPA data suggests that combustion of residual and distillate oils results in a hexavalent Cr emission rate that is 0.6% of the total Cr emitted from the tested sources (EPA, 1989; Estimating Air Toxics Emissions from Coal and Oil Combustion Sources. EPA-450/2-89-001).

The Pb RfD was derived from the NAAQS of $1.5 \mu\text{g}/\text{m}^3$ on a 90 day average basis. These assumptions are intentionally conservative to conform with the rationale of a screening level risk assessment for the proposed project. After reviewing the IRIS and HEAST data, it became apparent that the oral RfD's developed by EPA for Cu, Se, and Zn are inconsistent with available human dietary requirements, as provided by the National Academy of Sciences. Thus, ENSR has not included these parameters in the present health risk assessment.

Hazard indices and estimated lifetime excess cancer risks were generated for the appropriate chemicals based on the MEI. The hazard indices are applied to non-carcinogenic chemicals and represent a comparison between the estimated dose for the MEI and the RfD:

$$(\text{Est. dose for the MEI} / \text{RfD}) = \text{Hazard index}$$

Hazard Index values less than 1.0 indicate that adverse non-carcinogenic health effects are not expected to result for the MEI.

The lifetime excess cancer risks for individual carcinogenic emission products are evaluated based on the assumption that any estimated cancer risks for the MEI that are less than or equal to one in a million are considered small. As a comparison, EPA recently developed a NESHAPS

limit for benzene from coke by-products facilities based on a 4E-4 excess estimated cancer risk level for the MEI during regulation development.

4.5.1 Risk Characterization Results

The hazard indices and lifetime excess cancer risks resulting from the R&D facility for the MEI for the chemicals of interest are shown in Table 4-2. All hazard index results were significantly less than 1.0. The hazard indices were the greatest for Pb. In the case of Pb, the MEI is anticipated to be exposed to ambient air levels 0.034 of the RfD.

All carcinogenic emission products are associated with lifetime excess risks for the MEI of less than 1E-6. The highest estimated excess lifetime cancer risks are for hexavalent Cr (2.7E-7). Based on this conservative risk assessment, the potential health hazards associated with the R&D thermal treatment system are small.

4.6 Literature Cited

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SUMMARY OF ANALYTICAL RESULTS

PARAMETER	RDX				
	mWT.= SCFM	RATE MIN	RUN TIME MIN	CONC. μg	100 g/mole ppbv
RDX- 1-SED	47.25	60	21.6	2.69E-01	6.58E-02
RDX- 1-SWD	47.0	60	39.1	4.90E-01	1.20E-01
RDX- 1-NWU	47.5	60	22.0	2.73E-01	6.67E-02
RDX-1B-NWU	---	---	0.332		
RDX- 2-NED	47.5	63	27.5	3.25E-01	7.93E-02
RDX- 2~NWD	47.25	63	13.0	1.54E-01	3.77E-02
RDX-2C-NWD	51.5	60	33.1	3.78E-01	9.25E-02
RDX- 2-SEU	47.0	63	10.5	1.25E-01	3.06E-02
RDX-2B-SEU	---	---	0.253	U	
RDX-Trip Blk	---	---	0.253	U	

U = Undetected at specified detection limit.

Samples Not Blank Corrected

PARAMETER	Benz(k)Fluoranthenes mWT.= 252 g/mole				BENZO(e)PYRENE mWT.= 252 g/mole				BENZO(a)PYRENE mWT.= 252 g/mole			
	RATE	SAMPLE	CONC.	mWT.	CONC.	mWT.	CONC.	mWT.	CONC.	mWT.	CONC.	ppbv
SAMPLE ID	SCFM	MIN	µg	µg/M3	ppbv	µg	µg/M3	ppbv	µg	µg/M3	ppbv	ppbv
PAH- 1-SED	50.75	60	0.25	U	2.90E-03	2.81E-04	0.25	U	2.90E-03	2.81E-04	0.25	U
PAH-1C-SED	51.5	60	0.25	U	2.86E-03	2.77E-04	0.25	U	2.86E-03	2.77E-04	0.25	U
PAH- 1-SWD	45.25	60	0.25	U	3.25E-03	3.16E-04	0.25	U	3.25E-03	3.16E-04	0.25	U
PAH- 1-NWU	47.5	60	0.25	U	3.10E-03	3.01E-04	0.25	U	3.10E-03	3.01E-04	0.25	U
PAH-1B-NWU	---	---	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
PAH- 2-NED	47.5	63	0.25	U	2.95E-03	2.86E-04	0.25	U	2.95E-03	2.86E-04	0.25	U
PAH- 2-NWD	50.75	63	0.25	U	2.76E-03	2.68E-04	0.25	U	2.76E-03	2.68E-04	0.25	U
PAH- 2-SEU	45.25	63	0.25	U	3.10E-03	3.00E-04	0.25	U	3.10E-03	3.00E-04	0.25	U
PAH-2B-SEU	---	---	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
PAH- 3-NED	47.5	5	0.25	U	3.72E-02	3.61E-03	0.25	U	3.72E-02	3.61E-03	0.25	U
PAH- 3-NWD	50.75	62	0.25	U	2.81E-03	2.72E-04	0.08 J	8.98E-04	8.71E-05	0.04 J	4.49E-04	4.36E-05
PAH- 3-SEU	45.25	62	0.25	U	3.15E-03	3.05E-04	0.25	U	3.15E-03	3.05E-04	0.25	U
PAH- 4-NED	47.5	60	0.25	U	3.10E-03	3.01E-04	0.25	U	3.10E-03	3.01E-04	0.25	U
PAH- 4-NWD	47.75	22	0.25	U	8.40E-03	8.15E-04	0.25	U	8.40E-03	8.15E-04	0.25	U
PAH- 4-SEU	47	60	0.25	U	3.13E-03	3.04E-04	0.25	U	3.13E-03	3.04E-04	0.25	U
PAH- 5-NED	47.5	60	0.2	U	2.48E-03	2.40E-04	1.1	1.36E-02	1.32E-03	0.61	7.56E-03	7.33E-04
PAH- 5-NWD	50.75	60	0.39	U	4.52E-03	4.39E-04	1.8	2.09E-02	2.03E-03	1.1	1.28E-02	1.24E-03
PAH- 5-SEU	45.25	60	0.25	U	3.25E-03	3.16E-04	0.25	U	3.25E-03	3.16E-04	0.25	U
PAH-5B-SEU	---	---	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
PAH- 6-SED	50.75	61	0.44	U	5.02E-03	4.87E-04	2.3	2.62E-02	2.55E-03	1.7	1.94E-02	1.88E-03
PAH- 6-SWD	45.25	61	0.23	U	2.94E-03	2.86E-04	0.87	1.11E-02	1.08E-03	0.62	7.93E-03	7.70E-04
PAH- 6-NWU	47.5	61	0.25	U	3.05E-03	2.96E-04	0.25	U	3.05E-03	2.96E-04	0.25	U
PAH-6B-NWU	---	---	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U
PAH-Trip Blk	---	---	0.25	U	0.25	U	0.25	U	0.25	U	0.25	U

U = Undetected at specified quantitation limit.

J = Estimated-Results below detection limits.

Samples Not Blank Corrected

PARAMETER	INDENO(1,2,3,cd)PYRENE mWT.= 276 g/mole				Dibenz(a,c/a,h)Anthracene mWT.= 278 g/mole				CORONENE mWT.= 300 g/mole			
	RATE	SAMPLE CONC.	mWT.	ppbv	CONC.	mWT.	ppbv	CONC.	mWT.	ppbv	CONC.	mWT.
SAMPLE ID	SCFM	MIN	µg	µg/M3	µg	µg/M3	µg	µg	µg/M3	µg	µg/M3	µg
PAH- 1-SED	50.75	60	0.25	U	2.90E-03	2.57E-04	0.25	U	2.90E-03	2.55E-04	0.25	U
PAH-1C-SED	51.5	60	0.25	U	2.86E-03	2.53E-04	0.25	U	2.86E-03	2.51E-04	0.25	U
PAH- 1-SWD	45.25	60	0.25	U	3.25E-03	2.88E-04	0.25	U	3.25E-03	2.86E-04	0.25	U
PAH- 1-NWU	47.5	60	0.25	U	3.10E-03	2.74E-04	0.25	U	3.10E-03	2.72E-04	0.25	U
PAH-1B-NWU	---	---	0.25	U			0.25	U			0.25	U
PAH- 2-NED	47.5	63	0.25	U	2.95E-03	2.61E-04	0.25	U	2.95E-03	2.59E-04	0.25	U
PAH- 2-NWD	50.75	63	0.25	U	2.76E-03	2.45E-04	0.25	U	2.76E-03	2.43E-04	0.25	U
PAH- 2-SEU	45.25	63	0.25	U	3.10E-03	2.74E-04	0.25	U	3.10E-03	2.72E-04	0.25	U
PAH-2B-SEU	---	---	0.25	U			0.25	U			0.25	U
PAH- 3-NED	47.5	5	0.25	U	3.72E-02	3.29E-03	0.25	U	3.72E-02	3.27E-03	0.25	U
PAH- 3-NWD	50.75	62	0.25	U	2.81E-03	2.49E-04	0.25	U	2.81E-03	2.47E-04	0.25	U
PAH- 3-SEU	45.25	62	0.25	U	3.15E-03	2.79E-04	0.25	U	3.15E-03	2.77E-04	0.25	U
PAH- 4-NED	47.5	60	0.25	U	3.10E-03	2.74E-04	0.25	U	3.10E-03	2.72E-04	0.25	U
PAH- 4-NWD	47.75	22	0.25	U	8.40E-03	7.45E-04	0.25	U	8.40E-03	7.39E-04	0.25	U
PAH- 4-SEU	47	60	0.25	U	3.13E-03	2.77E-04	0.25	U	3.13E-03	2.75E-04	0.25	U
PAH- 5-NED	47.5	60	0.77	9.54E-03	8.45E-04	0.28		3.47E-03	3.05E-04	0.28		3.47E-03
PAH- 5-NWD	50.75	60	1.1	1.28E-02	1.13E-03	0.37		4.29E-03	3.77E-04	0.36		4.18E-03
PAH- 5-SEU	45.25	60	0.25	U	3.25E-03	2.88E-04	0.25	U	3.25E-03	2.86E-04	0.25	U
PAH-5B-SEU	---	---	0.25	U			0.25	U			0.25	U
PAH- 6-SED	50.75	61	1.5	1.71E-02	1.52E-03	0.23		2.62E-03	2.31E-04	0.70		7.99E-03
PAH- 6-SWD	45.25	61	0.52	6.65E-03	5.89E-04	0.25	U	3.20E-03	2.81E-04	0.25	U	2.61E-04
PAH- 6-NWU	47.5	61	0.25	U	3.05E-03	2.70E-04	0.25	U	3.05E-03	2.68E-04	0.25	U
PAH-6B-NWU	---	---	0.25	U			0.25	U			0.25	U
PAH-Trip Blk	---	---	0.25	U			0.25	U			0.25	U

U = Undetected at specified quantitation limit.

J = Estimated--Results below detection limits.

Samples Not Blank Corrected

SUMMARY OF ANALYTICAL RESULTS

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PARAMETER	SAMPLE ID	VOLUME cc/min	RUN TIME MIN	Sample mL	PHENOL		
					mwt.= CONC. μg/mL	94 μg/M3	CONC. ppbv
POL-1-SED	1158.8	60	29.4	0.05	U	2.45E-02	6.36E-03
POL-1C-SED	1121.9	60	29.0	0.05	U	2.56E-02	6.66E-03
POL-1-SWD	1155.8	60	28.8	0.05	U	2.51E-02	6.52E-03
POL-1-NWU	1161.1	60	29.3	0.05	U	2.45E-02	6.38E-03
POL-1B	—	—	40.0	0.05	U		
POL-2-NED	1137.0	60	28.5	0.05	U	2.57E-02	6.69E-03
POL-2-NWD	1145.6	60	28.6	0.05	U	2.54E-02	6.62E-03
POL-2-SEU	1164.8	35	28.0	0.05	U	4.38E-02	1.14E-02
POL-2B	—	—	40.0	0.06			
POL-3-NED	1176.5	60	28.3	0.05	U	2.50E-02	6.51E-03
POL-3-NWD	1108.7	60	29.2	0.05	U	2.57E-02	6.70E-03
POL-3-SEU	1180.1	60	29.0	0.05	U	2.44E-02	6.33E-03
POL-3B	—	—	40.0	0.05			
POL-4-NED	1128.0	60	29.0	0.05	U	2.55E-02	6.63E-03
POL-4-NWD	1096.9	60	29.0	0.05	U	2.62E-02	6.81E-03
POL-4-SEU	1154.1	60	28.8	0.05	U	2.51E-02	6.52E-03
POL-5-NED	1099.9	60	29.0	0.05	U	2.61E-02	6.80E-03
POL-5-NWD	1108.1	60	29.2	0.05	U	2.58E-02	6.70E-03
POL-5-SEU	1148.7	60	28.8	0.05	U	2.52E-02	6.55E-03
POL-6-SED	1125.9	60	29.0	0.05	U	2.55E-02	6.64E-03
POL-6-SWD	1145.7	60	29.2	0.05	U	2.49E-02	6.48E-03
POL-6-NWU	1144.3	60	28.5	0.05	U	2.56E-02	6.65E-03
POL-6B	—	—	40.0	0.06			
POL-1-TB	—	—	—	—	30.0	0.05	U
POL-Trip Blk1	—	—	—	—	40.0	0.07	U
POL-Trip Blk2	—	—	—	—	40.0	0.05	U

U = Undetected at specified detection limit.
 Samples Not Blank Corrected

PARAMETER	RATE SAMPLE ID	BENZENE		TOLUENE		ETHYL BENZENE		TOTAL XYLEMES	
		mWT.= MIN	sample CONC. NG	mWT.= CONC. NG	mWT.= CONC. NG	mWT.= CONC. NG	mWT.= CONC. NG	mWT.= CONC. NG	mWT.= CONC. NG
VOC-1-SED	1170.2	60	220	3.13E+00	9.82E-01	85	1.21E+00	3.22E-01	25 U
VOC-1C-SED	1069.7	60	74	1.15E+00	3.61E-01	53	8.26E-01	2.19E-01	25 U
VOC-1-SWD	1143.0	60	56	8.17E-01	2.56E-01	220	3.21E+00	8.53E-01	26 U
VOC-1-NWU	1043.2	60	41	6.55E-01	2.05E-01	34	5.43E-01	1.44E-01	25 U
VOC-1B-NWU	---	---	25 U	---	41	---	---	18 J	11 J
VOC-2-NED	1181.0	60	59	8.33E-01	2.61E-01	41	5.79E-01	1.54E-01	25 U
VOC-2-NWD	1157.1	60	25 U	3.60E-01	1.13E-01	14 J	2.02E-01	5.36E-02	25 U
VOC-2-SEU	1171.7	60	43	6.12E-01	1.92E-01	39	5.55E-01	1.47E-01	25 U
VOC-2B-SEU	---	---	25 U	---	25 U	---	---	25 U	25 U
VOC-3-NED	1131.7	60	140	2.06E+00	6.46E-01	130	1.91E+00	5.09E-01	16 J
VOC-3-NWD	1156.4	60	110	1.59E+00	4.97E-01	89	1.28E+00	3.41E-01	16 J
VOC-3-SEU	1169.9	60	150	2.14E+00	6.70E-01	140	1.99E+00	5.30E-01	16 J
VOC-3B-SEU	---	---	25 U	---	25 U	---	---	25 U	25 U
VOC-4-NED	1169.1	60	84	1.20E+00	3.75E-01	58	8.27E-01	2.20E-01	14 J
VOC-4-NWD	1132.3	60	50	7.36E-01	2.31E-01	45	6.62E-01	1.76E-01	25 U
VOC-4-SEU	1131.8	60	77	1.13E+00	3.55E-01	75	1.10E+00	2.94E-01	11 J
VOC-5-NED	1131.8	60	150	2.21E+00	6.92E-01	66	9.72E-01	2.58E-01	17 J
VOC-5-NWD	1163.9	60	510	7.30E+00	2.29E+00	140	2.00E+00	5.33E-01	62 U
VOC-5-SEU	1117.0	60	63	9.40E-01	2.95E-01	43	6.42E-01	1.71E-01	25 U
VOC-5B-SEU	---	---	1900 S	---	2300 S	---	3400 S	---	25 U
VOC-6-SED	1095.5	60	360	5.48E+00	1.72E+00	100	1.52E+00	4.04E-01	25 U
VOC-6-SWD	1172.4	60	390	5.54E+00	1.74E+00	130	1.85E+00	4.91E-01	27 U
VOC-6-NWU	1131.3	60	110	1.62E+00	5.08E-01	100	1.47E+00	3.92E-01	18 J
VOC-Trip Blk1	---	---	25 U	---	25 U	---	25 U	25 U	25 U
VOC-Trip Blk2	---	---	84	---	25 U	---	25 U	25 U	25 U

U = Undetected at specified detection limit.

J = Estimated value; Below detection limit.

S = Saturated

Samples Not Blank Corrected

PARAMETER	1-NITROPYRENE mWT.= 247 g/mole				Benzo(b)Fluoranthenes mWT.= 252 g/mole				Benzo(j)Fluoranthenes mWT.= 252 g/mole			
	RATE SCFM	SAMPLE MIN	mWT. CONC. μg	μg/M3	ppbv	mWT. CONC. μg	μg/M3	ppbv	mWT. CONC. μg	μg/M3	ppbv	ppbv
PAH- 1-SED	50.75	60	0.5 U	5.80E-03	5.74E-04	0.25 U	2.90E-03	2.81E-04	0.25 U	2.90E-03	2.81E-04	
PAH-1C-SED	51.5	60	0.5 U	5.71E-03	5.66E-04	0.25 U	2.86E-03	2.77E-04	0.25 U	2.86E-03	2.77E-04	
PAH- 1-SWD	45.25	60	0.5 U	6.50E-03	6.44E-04	0.25 U	3.25E-03	3.16E-04	0.25 U	3.25E-03	3.16E-04	
PAH- 1-NWU	47.5	60	0.5 U	6.20E-03	6.13E-04	0.25 U	3.10E-03	3.01E-04	0.25 U	3.10E-03	3.01E-04	
PAH-1B-NWU	---	---	0.5 U			0.25 U			0.25 U			
PAH- 2-NED	47.5	63	0.5 U	5.90E-03	5.84E-04	0.25 U	2.95E-03	2.86E-04	0.25 U	2.95E-03	2.86E-04	
PAH- 2-NWD	50.75	63	0.5 U	5.52E-03	5.47E-04	0.25 U	2.76E-03	2.68E-04	0.25 U	2.76E-03	2.68E-04	
PAH- 2-SEU	46.25	63	0.5 U	6.19E-03	6.13E-04	0.25 U	3.10E-03	3.00E-04	0.25 U	3.10E-03	3.00E-04	
PAH-2B-SEU	---	---	0.5 U			0.25 U			0.25 U			
PAH- 3-NED	47.5	5	0.5 U	7.43E-02	7.36E-03	0.25 U	3.72E-02	3.61E-03	0.25 U	3.72E-02	3.61E-03	
PAH- 3-NWD	50.75	62	0.5 U	5.61E-03	5.55E-04	0.25 U	2.81E-03	2.72E-04	0.25 U	2.81E-03	2.72E-04	
PAH- 3-SEU	45.25	62	0.5 U	6.29E-03	6.23E-04	0.25 U	3.15E-03	3.05E-04	0.25 U	3.15E-03	3.05E-04	
PAH- 4-NED	47.5	60	0.5 U	6.20E-03	6.13E-04	0.25 U	3.10E-03	3.01E-04	0.25 U	3.10E-03	3.01E-04	
PAH- 4-NWD	47.75	22	0.5 U	1.68E-02	1.66E-03	0.25 U	8.40E-03	8.15E-04	0.25 U	8.40E-03	8.15E-04	
PAH- 4-SEU	47	60	0.5 U	6.26E-03	6.20E-04	0.25 U	3.13E-03	3.04E-04	0.25 U	3.13E-03	3.04E-04	
PAH- 5-NED	47.5	60	0.5 U	6.20E-03	6.13E-04	0.76	9.42E-03	9.14E-04	0.44	5.45E-03	5.29E-04	
PAH- 5-NWD	50.75	60	0.5 U	5.80E-03	5.74E-04	1.2	1.39E-02	1.35E-03	0.73	8.47E-03	8.21E-04	
PAH- 5-SEU	45.25	60	0.5 U	6.50E-03	6.44E-04	0.25 U	3.25E-03	3.16E-04	0.25 U	3.25E-03	3.16E-04	
PAH-5B-SEU	---	---	0.5 U			0.25 U			0.25 U			
PAH- 6-SED	50.75	61	0.5 U	5.70E-03	5.65E-04	1.2	1.37E-02	1.33E-03	0.85	9.70E-03	9.41E-04	
PAH- 6-SWD	45.25	61	0.5 U	6.40E-03	6.33E-04	0.58	7.42E-03	7.20E-04	0.41	5.25E-03	5.09E-04	
PAH- 6-NWU	47.5	61	0.5 U	6.09E-03	6.03E-04	0.25 U	3.05E-03	2.96E-04	0.25 U	3.05E-03	2.96E-04	
PAH-6B-NWU	---	---	0.5 U			0.25 U			0.25 U			
PAH-Trip Blk	---	---	0.5 U			0.25 U			0.25 U			

U = Undetected at specified quantitation limit.

J = Estimated-Results below detection limits.

Samples Not Blank Corrected

PARAMETER	COPPER			NICKEL			LEAD			SELENIUM			ZINC		
	SAMPLE ID	RATE SCFM	RUN TIME MIN	CONC. μg	CONC. $\mu\text{g}/\text{M}^3$	CONC. μg									
P/M- 1-SED	60	47.5	15	1.86E-01	10 U	1.24E-01	4.4	5.45E-02	1 U	1.24E-02	59	7.31E-01			
P/M- 1-SWD	60	48.5	8.6	1.04E-01	10 U	1.21E-01	3.4	4.13E-02	1 U	1.21E-02	31	3.76E-01			
P/M- 1-NWU	55	46.75	15	2.06E-01	10 U	1.37E-01	2.5	3.43E-02	1 U	1.37E-02	66	9.06E-01			
P/M- 2-NED	63	46.75	8	9.59E-02	10 U	1.20E-01	2	2.40E-02	1 U	1.20E-02	22	2.64E-01			
P/M- 2-NWD	63	47.5	17	2.01E-01	10 U	1.18E-01	6.1	7.20E-02	1 U	1.18E-02	30	3.54E-01			
P/M- 2-SEU	63	48.5	5.6	6.47E-02	10 U	1.16E-01	2	2.31E-02	1 U	1.16E-02	13	1.50E-01			
P/M- 3-NED	5	46.75	6.1	9.22E-01	10 U	1.51E+00	2	3.02E-01	1 U	1.51E-01	17	2.57E+00			
P/M- 3-NWD	62	47.5	9.3	1.12E-01	10 U	1.20E-01	2.4	2.88E-02	1 U	1.20E-02	27	3.24E-01			
P/M-3C-NWD	62	51.5	16	1.77E-01	10 U	1.11E-01	2	2.21E-02	1 U	1.11E-02	16	1.77E-01			
P/M- 3-SEU	62	48.5	3.7	4.35E-02	10 U	1.17E-01	2.2	2.58E-02	1 U	1.17E-02	14	1.64E-01			
P/M- 4-NED	60	46.75	30	3.78E-01	10 U	1.26E-01	6.1	7.68E-02	1 U	1.26E-02	27	3.40E-01			
P/M- 4-NWD	22	47.5	5.8	1.96E-01	10 U	3.38E-01	4.1	1.39E-01	1 U	3.38E-02	27	9.12E-01			
P/M- 4-SEU	60	48.5	3.8	4.61E-02	10 U	1.21E-01	2	2.43E-02	1 U	1.21E-02	12	1.46E-01			
P/M- 5-NED	60	46.75	8.7	1.10E-01	10 U	1.26E-01	210	2.64E+00	1 U	1.26E-02	26	3.27E-01			
P/M- 5-NWD	60	47.5	17	2.11E-01	10 U	1.24E-01	460	5.70E+00	1 U	1.24E-02	25	3.10E-01			
P/M- 5-SEU	60	48.5	6	7.28E-02	10 U	1.21E-01	7.7	9.34E-02	1 U	1.21E-02	13	1.58E-01			
P/M-5B-SEU	---	---	2.6	---	---	---	3.7	---	1 U	---	12	---	---	---	
P/M- 6-SED	61	47.5	110	1.34E+00	10 U	1.22E-01	340	4.14E+00	1 U	1.22E-02	34	4.14E-01			
P/M- 6-SWD	61	48.5	38	4.54E-01	10 U	1.19E-01	160	1.91E+00	1 U	1.19E-02	20	2.39E-01			
P/M- 6-NWU	61	46.75	10	1.24E-01	10 U	1.24E-01	3.5	4.33E-02	1 U	1.24E-02	21	2.60E-01			
P/M-6B-NWU	---	---	3.8	---	---	6	---	1 U	---	15	---	---	---	---	
P/M-Trip Blk	---	---	2.8	---	---	10 U	2	U	1 U	U	12	---	---	---	

U = Undetected at specified detection limit.
 Samples Not Blank Corrected

PARAMETER		ALUMINUM		ANTIMONY		BARIUM		CADMIUM		CHROMIUM	
SAMPLE ID	RATE SCFM	RUN TIME MIN	CONC. μg	CONC. $\mu\text{g}/\text{M}^3$	CONC. μg						
P/M- 1-SED	60	47.5	470	5.82E+00	2	2.48E-02	68	8.43E-01	1	1.24E-02	2
P/M- 1-SWD	60	48.5	500	6.07E+00	2	2.43E-02	37	4.49E-01	1	1.21E-02	2
P/M- 1-NWU	55	46.75	450	6.18E+00	2	2.75E-02	76	1.04E+00	1	1.37E-02	1.9
P/M- 2-NED	63	46.75	300	3.60E+00	2	2.40E-02	20	2.40E-01	1	1.20E-02	1.7
P/M- 2-NWD	63	47.5	380	4.48E+00	2	2.36E-02	18	2.12E-01	1.1	1.30E-02	8.3
P/M- 2-SEU	63	48.5	240	2.77E+00	2	2.31E-02	15	1.73E-01	1	1.16E-02	1.3
P/M- 3-NED	5	46.75	220	3.32E+01	2	3.02E-01	9.8	1.48E+00	1	1.51E-01	1.7
P/M- 3-NWD	62	47.5	360	4.32E+00	2	2.40E-02	19	2.28E-01	1	1.20E-02	3.7
P/M- 3C-NWD	62	51.5	290	3.21E+00	2	2.21E-02	15	1.66E-01	1	1.11E-02	1.6
P/M- 3-SEU	62	48.5	250	2.94E+00	2	2.35E-02	13	1.53E-01	1	1.17E-02	1.3
P/M- 4-NED	60	46.75	320	4.03E+00	2	2.52E-02	15	1.89E-01	1	1.26E-02	1.5
P/M- 4-NWD	22	47.5	300	1.01E+01	2	6.76E-02	18	6.08E-01	1	3.38E-02	1.3
P/M- 4-SEU	60	48.5	260	3.16E+00	2	2.43E-02	11	1.33E-01	1.6	1.94E-02	1.4
P/M- 5-NED	60	46.75	370	4.66E+00	8.5	1.07E-01	27	3.40E-01	1.2	1.51E-02	1.4
P/M- 5-NWD	60	47.5	410	5.08E+00	18	2.23E-01	32	3.97E-01	1.5	1.86E-02	1.3
P/M- 5-SEU	60	48.5	230	2.79E+00	2	2.43E-02	13	1.58E-01	1	1.21E-02	1.4
P/M- 5B-SEU	—	—	320	—	2	—	13	—	1	—	1.5
P/M- 6-SED	61	47.5	590	7.19E+00	12	1.46E-01	30	3.66E-01	4.1	5.00E-02	6.7
P/M- 6-SWD	61	48.5	400	4.77E+00	6.6	7.88E-02	21	2.51E-01	1.8	2.15E-02	1.7
P/M- 6-NWU	61	46.75	260	3.22E+00	2	2.48E-02	15	1.86E-01	1	1.24E-02	1.8
P/M-6B-NWU	—	—	350	—	2	—	23	—	1	—	1.5
P/M-Trip Blk	—	—	220	—	2	—	11	—	1	—	1.5

U = Undetected at specified detection limit.
Samples Not Blank Corrected

SUMMARY OF ANALYTICAL RESULTS

PARAMETER	2,6-DINITROTOLUENE			2,4-DINITROTOLUENE			2,4,6-TRINITROTOLUENE		
	RATE SLPM	RUN TIME MIN	CONC. μg	mWT.= 182 g/mole	CONC. μg	mWT.= 182 g/mole	CONC. μg	mWT.= 227 g/mole	
SAMPLE ID			ng/M3	ppbv	ng/M3	ppbv	ng/M3	ppbv	
TNT- 3-NED	265	60	1.43	89.94	12.08	0.25	U	15.72	
TNT- 3-NWD	255	60	1.15	75.16	10.10	0.25	U	16.34	
TNT-3C-NWD	255	60	1.11	72.55	9.75	0.25	U	16.34	
TNT- 3-SEU	266	60	1.25	78.32	10.52	0.25	U	15.66	
TNT-3B-SEU	--	--	1.66	--	--	0.53	--	--	
TNT- 4-NED	265	60	4.54	285.53	38.36	1.27	79.87	10.73	
TNT- 4-NWD	260	60	1.37	87.82	11.80	0.25	U	16.03	
TNT- 4-SEU	266	60	0.99	62.03	8.33	0.52	32.58	4.38	
TNT-Trip Blk	--	--	--	0.97	--	0.25	U	0.14	

U = Undetected at specified detection limit.
 Sample Not Blank Corrected

SUMMARY OF ANALYTICAL RESULTS

PARAMETER		PARTICULATE		
SAMPLE ID	RATE SCFM	RUN TIME MIN	CONC. G	µg/M3
P/M- 1-SED	60	47.5	0.0028	3.47E+01
P/M- 1-SWD	60	48.5	0.0017	2.06E+01
P/M- 1-NWU	55	46.75	0.0015	2.06E+01
P/M- 2-NED	63	46.75	0.0015	1.80E+01
P/M- 2-NWD	63	47.5	0.0113	1.33E+02
P/M- 2-SEU	63	48.5	0.0000	1.16E-01
P/M- 3-NED	5	46.75	0.0012	1.81E+02
P/M- 3-NWD	62	47.5	0.0087	1.04E+02
P/M-3C-NWD	62	51.5	0.0071	7.85E+01
P/M- 3-SEU	62	48.5	0.0012	1.41E+01
P/M- 4-NED	60	46.75	0.0046	5.79E+01
P/M- 4-NWD	22	47.5	0.0021	7.10E+01
P/M- 4-SEU	60	48.5	0.0008	9.71E+00
P/M- 5-NED	60	46.75	0.0036	4.53E+01
P/M- 5-NWD	60	47.5	0.0088	1.09E+02
P/M- 5-SEU	60	48.5	0.0016	1.94E+01
P/M- 6-SED	61	47.5	0.0131	1.60E+02
P/M- 6-SWD	61	48.5	0.0046	5.49E+01
P/M- 6-NWU	61	46.75	0.0033	4.09E+01

Data Not Blank Corrected

TCT - St. Louis

Consulting Engineers, Scientists and Analytical Services

formerly Envirodyne Engineers, Inc.

1908 Innerbelt Business Center Drive
St. Louis, Missouri 63114-5700
Phone (314) 426-0880
Fax (314) 426-4212

February 6, 1991
3500-55000

Mr. Mark Greenberg
ENSR
35 Nagog Park
Acton, Massachusetts 01720

Dear Mr. Greenberg:

Please find enclosed, the hard copy analytical results for RDX analysis on ten filter samples received at TCT-St. Louis on January 16, 1991.

These samples are associated with Purchase Order Number 84268.

These samples correspond to TCT-St. Louis' Sample Numbers 91000087 to 91000096.

Thank you for choosing TCT-St. Louis for these analytical services.

If you have any questions, please contact me at (314) 426-0880.

Sincerely,

Allen M. Field

Allen M. Field
Project Manager

AMF/jam/AF197/1
Enclosure

TCT - St. Louis

Consulting Engineers, Scientists and Analytical Services

formerly Envirodyne Engineers, Inc.

1908 Innerbelt Business Center Drive
St. Louis, Missouri 63114-5700
Phone (314) 426-0880
Fax (314) 426-4212

CLIENT: Pat North or Mark Greenberg
ENSR Consulting and Engineering
35 Magog Park
Action, MA 01720

REPORT DATE: February 1, 1991
SAMPLE ANALYZED: Ten filter samples analyzed
for RDX.

PROJECT #: 3500-000550
TCT ST. LOUIS ID #: 91000087 - 91000096

DATE RECEIVED: January 16, 1991
P.O. #: 84268

SITE	RDX
CODE	(DG/WIPE)
METHOD BLANK	< 0.253
LCS 4940	113 % RECOVERY
TRIP BLANK RDX	< 0.253
RDX-2-MED	27.5
RDX-2C-NWD	33.1
RDX-2-NWD	13.0
RDX-2B-SEU (1:10 DILUTION)	< 2.53
RDX-2-SEU	10.5
X-1B-NWD	0.332
X-1-NWD	22.0
RDX-1-SED	21.6
RDX-1-SWD	39.1

NOTE: See reverse side for "STANDARD CLAUSES".

APPROVED: *Allen M. Field*
Allen M. Field, Project Manager

Mark 97/jah

ENSR ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
PAHS IN AIR

PROJECT ID: 3246-001-610
PROJECT NAME: RAD Mfg. Inc./CSX

METHOD: SIM GC/MS

PARAMETER:	LAB. SAMPLE NO.	FIELD IDENT NO.	DATE SAMPLED	DATE ANALYZED	83138		83140		83141		83142		83143		83144		83144	
					PAH-5-MED	01/14/91	PAH-5-SEU	01/14/91	PAH-6-BAU	01/16/91	PAH-6-SMU	01/16/91	PAH-6-SED	01/16/91	TRIP. BLANK	01/16/91	TRIP. BLANK	02/13/91
	TOTAL US				TOTAL US			TOTAL US			TOTAL US			TOTAL US		TOTAL US		TOTAL US
1-B1 TROPTRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5 U	0.59	1.2	0.5 U	0.25 U	0.25 U	0.25 U	
BENZ(O,J)FLUORANTHENE	0.76	0.76	0.76	0.76	0.76	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.41	0.46	0.44	0.25 U	0.25 U	0.25 U	0.25 U	
SENZOLK FLUORANTHENE	0.44	0.44	0.44	0.44	0.44	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25	0.25	0.25	0.25 U	0.25 U	0.25 U	0.25 U	
BENZ(E)PYRENE	0.20	0.20	0.20	0.20	0.20	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25	0.25	0.25	0.25 U	0.25 U	0.25 U	0.25 U	
BENZ(A)PYRENE	1.1	1.1	1.1	1.1	1.1	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.87	2.3	0.87	0.25 U	0.25 U	0.25 U	0.25 U	
INDENOL 125,OD)PYRENE	0.61	0.61	0.61	0.61	0.61	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.62	1.7	0.62	0.25 U	0.25 U	0.25 U	0.25 U	
DIBENZ(A,C)A,INDAN PYRENE	0.77	0.77	0.77	0.77	0.77	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.52	1.5	0.52	0.25 U	0.25 U	0.25 U	0.25 U	
CORONENE	0.28	0.28	0.28	0.28	0.28	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25	0.25	0.25	0.25 U	0.25 U	0.25 U	0.25 U	
SURROGATE % RECOVERY					X	X	X	X	X	X	X	X	X	X	X	X	X	
CARY SENE, D12	97	90	92	91										95	98	99		
PERYLENE, D12	93	87	86	83										94	101	95		

U = Undetected at specified quantitation limit.

REVIEWED BY/DATE: HJM / 2/13/91 acetate:

ENSR ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
PAHS IN AIR

PROJECT NO. PROJECT NAME	METHOD: SIM GC/FID																			
	83129 PAH-2B-SEU 01/13/91 02/12/91			83131 PAH-3-SEU 01/14/91 02/12/91			83132 PAH-3-MD 01/14/91 02/13/91			83133 PAH-4-SEU 01/14/91 02/12/91			83134 PAH-4-MD 01/14/91 02/13/91		83135 PAH-5-SEU 01/14/91 02/13/91		83136 PAH-5-MD 01/14/91 02/13/91		83137 PAH-5-MD 01/14/91 02/13/91	
PARAMETER:	TOTAL US		TOTAL US		TOTAL US		TOTAL US		TOTAL US		TOTAL US		TOTAL US		TOTAL US		TOTAL US		TOTAL US	
	0.5 U	0.5 U	0.5 U	0.25 U	0.25 U	0.25 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1-NI TRIPHENYL BENZOX(3)FLUORANTHENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
BENZOX(3)FLUORANTHENE BENZOX(3)FLUORANTHENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
BENZ(6)PYRENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
BENZ(1A)PYRENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
INDI MDX 123, CD PYRENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
DIBENZ(A,C)ANTHRAQUINE CORONENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
SURROGATE % RECOVERY	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CHRY SEN#, D12	102	106	66	102	111	76	86	88	90	99	97	102	99	98	99	98	99	98	99	98
PERY LENE, D12	101	115	75																	

U = Undetected at specified quantitation limit.

J = Estimated Results below detection limits.

REVIEWED BY/DATE: W/12/91 OC/DATE: W/12/91

EISR ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
PARTS IN AIR

		METHOD: SIM GC/MS																				
PROJECT NO.	PROJECT NAME	83121			83122			83123			83125			83126			83127			83128		
LAB SAMPLE NO.	BLANK	PBM-1-SBD	PBM-1-SED	PBM-1-SED	PBM-1-SBD																	
FIELD IDENT NO.	01/31/91	01/12/91	02/13/91	02/12/91	01/12/91	02/13/91	02/12/91	01/12/91	02/13/91	02/13/91	01/12/91	02/13/91	02/13/91	01/12/91	02/13/91	01/13/91	02/12/91	01/13/91	02/12/91	01/13/91	02/12/91	
DATE SAMPLED																						
DATE ANALYZED	(2/12/91)																					
PARAMETER:																						
TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	TOTAL US	
1-MITROBUTRENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
BENZ[O]BIFLUOROMETHANE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
BENZ[O]CFLUOROMETHANE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
BENZOCFLUOROMETHANE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
BENZ[1]EPHTERENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
BENZ[2]EPHTERENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
BENZ[2]APYRENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
INDENO[1,2,3-CD]APYRENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
DIBENZ[A,C]A,1,4-NAPHTACENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	
CORONENE																						
SURROGATE % RECOVERY	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CHRYSENE, D12	86	88	93	96	98	92	107	90	96	98	92	95	99	91	91	95	99	91	91	95	91	
PERYLENE, D12	82	80	92	97	95	90	107	93	96	98	92	95	99	91	91	95	99	91	91	95	91	

U = Undetected at specified quantitation limit. NS = Not Spotted T = Tentative identification

REVIEWED BY/DATE: MICHAEL J. KELLY OC/DATE: _____

ENSR ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
DNT/TNT from PUF-NADS

PROJECT NO. PROJECT NAME	METHOD: SIM GC/MS											
	83105 TNT-SEU 01/14/91 02/09/91	83106 TNT-3-SEU 01/14/91 02/09/91	83107 TNT-3-NAD 01/14/91 02/09/91	83108 TNT-3C-NAD 01/14/91 02/09/91	83109 TNT-3-NED 01/14/91 02/09/91	83110 TNT-4-SEU 01/14/91 02/09/91	83111 TNT-4-NAD 01/14/91 02/09/91	83112 TNT-4-NED 01/14/91 02/09/91	83113 TRIP BLANK 01/14/91 02/09/91	TOTAL UG	TOTAL UG	
PARAMETER:												
2,6-Dinitrotoluene	1.66	1.25	1.15	1.11	1.43	0.99	1.37	4.54	0.97			
2,4-Dinitrotoluene	0.53	0.25 U	0.25 U	0.25 U	0.25 U	0.52	0.25 U	1.27	0.25 U			
2,4,6-Trinitrotoluene	2.06	0.22	0.74	1.13	0.47	0.21	2.97	6.81	0.14			
LAB SAMPLE NO. FIELD IDENT NO. DATE SAMPLED DATE ANALYZED	LAB BLANK 01/21/91 02/11/91											
PARAMETER:												
2,6-Dinitrotoluene		0.12										
2,4-Dinitrotoluene		0.25 U										
2,4,6-Trinitrotoluene		0.92										

REVIEWED BY/DATE: MJ / 01/14/91 QC/DATE: JK



Formerly ERT

TELECOPY TRANSMITTAL SHEET

ENSR Consulting
and Engineering1229 Avenida Acaso
Camarillo, CA 93010
(805) 388-3775Panafax 400D (Auto)
(805) 388-3777Any Problems Call:
(805) 388-3775Number of Pages: Cover + 1Date: 3/5/91TO: Ron HarkovCOMPANY: ENSR, SOMERSET, N.J.

FAX NO.: _____

COMPANY TELEPHONE NO.: _____

FROM: Lily C. Tomlin Ext. 117PROJECT REFERENCE: 3246-001-610COMMENTS: Recovery DATA for GSXReturn Original to Author? ✓

3/6/91

R + D Mfg. Inc. / GSX

8501-091-527 / 3246-001-610

Sample POL-1-B was spiked with
0.098 ug/me standard,
recovery is 99.7%.

J. T. Meier



Air Analysis Laboratory

LABORATORY ANALYSIS REPORT

CLIENT: R & D Mfg. Inc./GSX
PROJECT NO.: 8501-091-567/3246-001-610
PROJECT LOCATION: Colfax, LA
DATE OF RECEIPT: 01/16/91
DATE OF ANALYSIS: 01/18/91
DATE OF REPORT: 01/23/91

<u>Sample ID</u>	<u>Sampling Date & Time</u>	<u>Phenols Conc. (uG/mL)</u>
POL-1-NWU	01/12/91 16:19	< 0.05
POL-1-SWD	01/12/91 16:19	< 0.05
POL-1-SED	01/12/91 16:19	< 0.05
POL-1C-SED	01/12/91 16:19	< 0.05
POL-1B	01/12/91 16:19	< 0.05
POL-2-SEU	01/13/91 12:18	< 0.05
POL-2-NWD	01/13/91 12:18	< 0.05
POL-2-NED	01/13/91 12:18	< 0.05
POL-2B	01/13/91 12:18	0.06
POL-3-SEU	01/14/91 10:12	< 0.05
POL-3-NED	01/14/91 10:12	< 0.05
POL-3-NWD	01/14/91 10:12	< 0.05
POL-3B	01/14/91 11:50	0.05
POL-4-SEU	01/14/91 13:42	< 0.05
POL-4-NED	01/14/91 13:42	< 0.05
POL-4-NWD	01/14/91 13:42	< 0.05
POL-5-SEU	01/14/91 16:45	< 0.05
POL-5-NED	01/14/91 16:45	< 0.05
POL-5-NWD	01/14/91 16:45	< 0.05
POL-1-TB	01/14/91 16:45	< 0.05
POL-TRIP BLK	01/15/91 10:50	0.07
POL-6-NWU	01/16/91 11:38	< 0.05
POL-6-SWD	01/16/91 11:38	< 0.05
POL-6-SED	01/16/91 11:38	< 0.05
POL-6B	01/16/91 11:38	0.06
POL-TRIP BLK 2	01/16/91 11:38	< 0.05

REPLICATES

POL-1-SED	01/12/91 16:19	< 0.05
POL-3-NWD	01/14/91 10:12	< 0.05
POL-6-NWU	01/16/91 11:38	< 0.05
POL-TRIP BLK	01/15/91 10:50	0.07

Lily C. Tomlin
Laboratory Operations Manager

ANALYTICEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
SELECT METALS ON FILTER

PROJECT NAME: R & D Manufacturing
SAMPLING SITE: Cofax, LA
PROJECT NO.: 6500-090-252C
UNITS: µg/filter

LAB NO.:	83182	83183	83184	83187	83188	83189	83190	83191	83192	METHOD OF ANALYSIS
FLO ID NO.:	P/M-1-SED	P/M-1-NAU	P/M-2-SEU	P/M-2-NED	P/M-2-NED	P/M-3-SEU	P/M-3-NED	P/M-3-NED	P/M-3-NED	DETECTION LIMIT
DATE SAMPLED:	01/12/91	01/12/91	01/13/91	01/13/91	01/13/91	01/14/91	01/14/91	01/14/91	01/14/91	01/14/91
DATE ANALYZED:	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91
ALUMINUM	470	500	730 *	240 *	360	250	220	360	200	10
ANTHONY	BDL *	BDL *	BDL *	BDL *	BDL	BDL	BDL	BDL	BDL	2.0
BARIUM	37	76 *	13 *	20	18	13	9.8	19	15	5.0
CADMIUM	68	BDL *	BDL	BDL	BDL	1.1	BDL	BDL	BDL	1.0
CERIUM	2.0	2.0	1.9 *	1.5 *	1.7	8.3	1.3	1.7	3.7	1.0
COPPER	13	8.6	15 *	5.6 *	8.0	17	3.7	6.1	9.3	1.6
NICKEL	BDL	BDL *	BDL *	BDL *	BDL	BDL	BDL	BDL	BDL	1.0
LEAD	4.4	3.4	2.5 *	BDL *	BDL	6.1	2.2	BDL	2.4	1.0
SELENIUM	BDL	BDL	BDL *	BDL	BDL	BDL	BDL	BDL	BDL	1.0
ZINC	39	31	66 *	13 *	22	30	14	17	27	10

BDL = Below detection limit * = Analyzed in duplicate, the mean has been reported.

REVIEWED BY DATE: Mark Howell AC DATE: 3/17/1991 2/18/91

ANALYTIKEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
SELECT METALS ON FILTER

PROJECT NAME: R & D Manufacturing
SAMPLING SITE: Colfax, LA
PROJECT NO.: 8500-000-252C
UNITS: ug/filter

				METHOD OF ANALYSIS					
LAB ID:	83194	83195	83197	83198	83199	83200	83202	83203	DETECTION LIMIT
FLD ID NO.:	P/N-4-SEU	P/N-4-NED	P/N-5-SEU	P/N-5-NED	P/N-5-NED	P/N-5-NED	P/N-6-NAU	P/N-6-NAU	
DATE SAMPLED:	01/14/91	01/14/91	01/14/91	01/14/91	01/14/91	01/16/91	01/16/91	01/16/91	
DATE ANALYZED:	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	02/07/91	
ALUMINUM	260	300	320	330	370	410	260	350	400
ANTHONY	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10
BARIUM	15	18	13	13	27	32	15	23	6.6
CADMIUM	1.6	BDL	BDL	BDL	1.2	1.5	BDL	BDL	2.0
CHROMIUM	1.4	1.5	1.3	1.5	1.4	1.4	1.3	1.3	5.0
COPPER	3.8	30	5.6	2.6	6.0	6.7	17	10	1.0
NICKEL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.0
LEAD	BDL	6.1	6.1	3.7	7.7	210 +	6.0	160 +	2.0
SELENIUM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.0
ZINC	12	27	27	12	13	26	25	21	20

BDL = Below detection limit + = Analyzed by method 6010; Detection limit is 20 ug/filter.

REVIEWED BY DATE: J. M. Johnson 2/10/91
APPROVED BY DATE: J. M. Johnson 2/10/91

ANALYTIKEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
SELECT METALS ON FILTER

PROJECT NAME: R & D Manufacturing
 SAMPLING SITE: Colfax, LA
 PROJECT NO.: 8500-000-252C
 UNITS: ug/filter

LAB NO.:	FLD ID NO.:	P/N-6-SED	TRIP BLANK-P/N 01/16/91 02/07/91	DETECTION LIMIT		METHOD OF ANALYSIS
				10	6010	
ALUMINUM	83204	590	220			
ANTIMONY		12	BDL			
BARIUM		30	11			
CAIUM		4.1	BDL			
CHROMIUM		6.7	1.5			
COPPER		110 #	2.8			
NICKEL		BDL	BDL			
LEAD		340 **	BDL			
SELENIUM		BDL	BDL			
ZINC		34	12			

† = Below detection limit + = Analyzed by method 6010; Detection limit is 20 ug/filter.
 * = Analyzed in duplicate, the mean has been reported.
 ** = Analyzed by method 6010; Detection limit is 5.0 ug/filter.

REVIEWED BY/DATE: L. Pettigrew DATE: 2/4/91

ANALYTICKEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
QUALITY CONTROL CHECK SAMPLES
SELECT METALS ON FILTER

PROJECT NAME: R & D Manufacturing
SAMPLING SITE: Colfax, LA
PROJECT NO.: 6500-050-252C

BLANK FILTER RESULTS

LAB NO.:	MSP910047	MSP910048	MSP910029	MSP910029	ICP
FLD ID NO.:	LOT# 87049	LOT# 87049	LOT# 87049	% RECOVERY	DETECTION LIMIT
DATE SAMPLED:	N/A	N/A	N/A	N/A	METHOD OF ANALYSIS
DATE ANALYZED:	02/07/91	02/07/91	02/07/91	N/A	
SPICE ADDED:	N/A	N/A	20.0	N/A	
SPICE ADDED:	N/A	N/A	N/A	100	
ALUMINUM	476	246	NA	60.8 a	6010
ANTIMONY	BDL	BDL	12.2	61	7000
BARIUM	100	14.8	NA	NA	2.0
CADMIUM	BDL	BDL	16.2	81	6010
CHROMIUM	1.50	1.22	21.0	105	5.0
COPPER	BDL	2.54	18.6	93	1.0
NICKEL	BDL	BDL	NA	65.8	7000
LEAD	BDL	BDL	15.8	79	2.0
SELENIUM	BDL	BDL	15.8	79	7000
ZINC	72.2	12.0	NA	94.4	10

BDL = Below detection limit

a = This value was blank corrected using the mean of MSP910047 and MSP910048.

SPIKED FILTER RESULTS

LAB NO.:	MSP910029	MSP910029	LCSP910030	LCSP910030	ICP
FLD ID NO.:	LOT# 87049	LOT# 87049	LOT# 87049	% RECOVERY	DETECTION LIMIT
DATE SAMPLED:	N/A	N/A	N/A	N/A	METHOD OF ANALYSIS
DATE ANALYZED:	02/07/91	02/07/91	02/07/91	N/A	
SPICE ADDED:	20.0	N/A	N/A	100	
ALUMINUM	NA	NA	60.8 a	61 a	6010
ANTIMONY	NA	NA	NA	NA	7000
BARIUM	NA	NA	NA	107	5.0
CADMIUM	NA	NA	NA	NA	6010
CHROMIUM	NA	NA	NA	NA	1.0
COPPER	NA	NA	NA	NA	7000
NICKEL	NA	NA	NA	NA	2.0
LEAD	NA	NA	NA	NA	7000
SELENIUM	NA	NA	NA	NA	1.0
ZINC	NA	NA	NA	NA	6010

REVIEWED BY/DATED: MH/MSK OC DATE: 3/17/1991 1991

ANALYTICAL ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
QUALITY CONTROL CHECK SAMPLES
SELECT METALS ON FILTER

PROJECT NAME: R & D Manufacturing
SAMPLING SITE: Colfax, LA
PROJECT NO.: 0300-030-252C

METHOD BLANK RESULTS

LAB NO.:	MB910056 REAGENT N/A DATE SAMPLED: 02/07/91 UNITS MC/L	DETECTION LIMIT	TRUE VALUES	% RECOVERY	METHOD OF ANALYSIS
ALUMINUM	BDL	0.050	10,700	34,200	6010
ANTIMONY	BDL	0.010	14.9	(45)	N/A
BARIUM	BDL	0.025	541	(73)	N/A
CHromium	BDL	0.005	77.9	75.0	6010
CHROMIUM	BDL	0.005	91.9	403	7000
COPPER	BDL	0.005	593	609	7000
NICKEL	BDL	0.050	36.6	82.0	N/A
LEAD	BDL	0.010	5,510 +	6,550	6010
SELENIUM	BDL	0.005	21.6	27.0	7000
ZINC	BDL	0.050	3,820	4,760	6010

BDL = Below detection limit

Analyzed by method 6010.

(+) = Indicate non-certified values and are supplied for information only.
+ = Estimated value; Detection limit is 50 ug/g.

N/A = Not Applicable

LAB SPIKE RESULTS

LAB NO.:	LCS910031 SN1648 N/A 02/07/91 UG/G	TRUE VALUES	% RECOVERY	METHOD OF ANALYSIS
ALUMINUM	10,700	34,200	31	7000
ANTIMONY	14.9	(45)	N/A	6010
BARIUM	541	(73)	N/A	6010
CHromium	77.9	75.0	104	7000
CHROMIUM	91.9	403	23	7000
COPPER	593	609	97	7000
NICKEL	36.6	82.0	N/A	6010
LEAD	5,510 +	6,550	84	7000
SELENIUM	21.6	27.0	80	7000
ZINC	3,820	4,760	80	6010

N/A = Not Applicable

REVIEWED BY/DATE: J. P. Lamore
ACQ/DATE: Metzger

MULTIVEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS

PROJECT NAME: R & D Manufacturing
SAMPLING SITE: Coal Fox, LA
PROJECT NO.: 8500-090-252C
UNIT #: 1g/filter

ANALYTICAL DUPLICATE RESULTS

LAB NO.:	83102	83103	RELATIVE PERCENT DIFFERENCE	83104		83105		83106		83107		83108	
				P/N-1-SEB 01/12/91 02/07/91	P/N-1-MAU 01/12/91 02/07/91	P/N-1-SEB 01/12/91 02/07/91	P/N-1-MAU 01/12/91 02/07/91	P/N-2-SEB 01/13/91 02/07/91	P/N-2-MAU 01/13/91 02/07/91	P/N-2-SEB 01/13/91 02/07/91	P/N-2-MAU 01/13/91 02/07/91	P/N-2-SEB 01/13/91 02/07/91	P/N-2-MAU 01/13/91 02/07/91
ALUMINUM	NA	NA	NA	450	444	1.3	NA	258	252	1.6	10	6010	
ANTIMONY	NA	NA	NA	NDL	NDL	NA	NDL	NDL	NDL	NA	2.0	7000	
BARIUM	NA	NA	NA	79.2	73.4	7.6	16.0	13.8	15	NA	5.0	6010	
CAPILLAR	NDL	NDL	NA	NA	NA	NA	NA	NA	NA	NA	1.0	7000	
CERIUM	NA	NA	NA	1.08	1.08	0	1.25	1.25	1.25	NA	3.2	1.0	7000
COPPER	NA	NA	NA	14.8	14.6	1.4	5.35	5.65	5.65	NA	1.0	7000	
NICKEL	NA	NA	NA	NDL	NDL	NA	NDL	NDL	NDL	NA	10	6010	
LEAD	NA	NA	NA	2.68	2.26	18	NDL	NDL	NDL	NDL	2.0	7000	
SELENIUM	NA	NA	NA	NDL	NDL	NA	NDL	NDL	NDL	NA	1.0	7000	
ZINC	NA	NA	NA	66.2	65.6	< 1.0	12.4	13.2	6.3	NA	10	6010	

NDL = Below detection limit NA = Not Applicable

REVIEWED BY/DATE: J. M. Hansen 3/15/91
APPROVED BY/DATE: J. M. Hansen 3/15/91

ANALYTIKEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
87K ON TENAX

PROJECT NO.	8500-091-252 & 252B	LAB SAMPLE NO.	83091	LAB SAMPLE NO.	83095	LAB SAMPLE NO.	83084	LAB SAMPLE NO.	83088	LAB SAMPLE NO.	83085
PROJECT NAME	R & D MANUFACTURING - COLFAX, LA	FIELD IDENT NO.	MR910038	FIELD IDENT NO.	VOC-2-MED	FIELD IDENT NO.	VOC-1-MAU	FIELD IDENT NO.	MR910040	FIELD IDENT NO.	VOC-1B-MAU
DATE SAMPLED	01/15/91	DATE SAMPLED	01/23/91	DATE SAMPLED	01/12/91	DATE SAMPLED	01/23/91	DATE SAMPLED	01/24/91	DATE SAMPLED	01/12/91
DATE ANALYZED	01/17/91	DATE ANALYZED	01/23/91	DATE ANALYZED	01/23/91	DATE ANALYZED	01/23/91	DATE ANALYZED	01/24/91	DATE ANALYZED	01/24/91
PARAMETER:		RESULTS (#)		RESULTS (#)		RESULTS (#)		RESULTS (#)		RESULTS (#)	
BENZENE	59	(%)	25	(%)	110	(%)	74	(%)	25	(%)	25 U
TOLUENE	41	(%)	25	(%)	89	(%)	53	(%)	25	(%)	41
ETHYL BENZENE	25	(%)	25	(%)	16	(%)	25	(%)	25	(%)	18 J
TOTAL XYLENES	13	(%)	25	(%)	40	(%)	10	(%)	25	(%)	11 J
SURROGATE RECOVERY		(%)		(%)		(%)		(%)		(%)	
1,2-DICHLOROETHANE, D4	105	(%)	78	(%)	72	(%)	76	(%)	85	(%)	52
BENZENE, D6	116	(%)	96	(%)	121	(%)	111	(%)	100	(%)	18 **
TOLUENE, D8	98	(%)	92	(%)	89	(%)	92	(%)	97	(%)	82
BROMOFLUOROBENZENE	81	(%)	95	(%)	104	(%)	80	(%)	97	(%)	100

U = Undetected at specified detection limit.

J = Estimated value; Below detection limit.

B = Found in method blank.

E = Exceeds upper limit of calibration.
 * = Outside laboratory control limits; See discussion.

REVIEWED BY/DATE: M. H. Sifre OC/DATE: P. M. Nieman 3/17/91

ANALYTICEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
BTEX ON TEFAX

PROJECT NO.	8500-091-252 & 2528	PROJECT NAME	R & D MANUFACTURING - COLFAX, LA	LAB SAMPLE NO.	83106	83116	83117	83118	83119
FIELD IDENT NO.		VOC-6-SEU	VOC-6-SUD	RESULTS	(NG)	(NG)	(NG)	VOC-6-SEU	VOC-6-SAU
DATE SAMPLED	01/16/91	01/16/91	01/16/91	RESULTS	(NG)	(NG)	(NG)	01/16/91	01/16/91
DATE ANALYZED	01/26/91	01/26/91	01/26/91	RESULTS	(NG)	(NG)	(NG)	01/26/91	01/26/91
PARAMETER:				RESULTS	(NG)	(NG)	(NG)	RESULTS	RESULTS
BENZENE	1900 S	110	390	(NG)	360	25	25	25 U	25 U
TOLUENE	2300 S	100	130	(NG)	100	25	25	25 U	25 U
ETHYL BENZENE	34.00 ES	18 J	27	(NG)	25	25	25	25 U	25 U
TOTAL XYLENES	25 U	23 J	35	(NG)	15 J	25	25	25 U	25 U
SURROGATE RECOVERY	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
1,2-DICHLOROETHANE, D4	96	93	90	(X)	(X)	(X)	(X)	92	92
BENZENE, D6	99	122	129	(X)	(X)	(X)	(X)	137	137
TOLUENE, D8	84	95	90	(X)	(X)	(X)	(X)	90	90
BROMOFLUOROBENZENE	116	70	109	(X)	(X)	(X)	(X)	97	97

U = Undetected at specified detection limit.

J = Estimated value; Below detection limit.

S = Found in method blank.

E = Exceeds upper limit of calibration.

S = Saturated

REVIEWED BY/DATED: J. M. Hansen 2/17/91
QC/DATE: J. M. Hansen 2/17/91

ANALYTIKEN ANALYTICAL LABORATORY
SUMMARY OF ANALYTICAL RESULTS
QUALITY CONTROL CHECK SAMPLES
BTX ON TENAX

PROJECT NO. 8500-090-252 & 252B
PROJECT NAME R & D MANUFACTURING - COLFAX, IA

LAB SAMPLE NO.	LCS910029	RESULTS (%)	RESULTS (%)
FIELD ID NO.	LAB SPIKE	LAB SPIKE	LAB SPIKE
DATE SAMPLED	01/17/91	01/23/91	01/24/91
DATE ANALYZED	01/17/91	01/23/91	01/24/91
PARAMETER:			
BENZENE	88	113	110
TOLUENE	106	113	102
ETHYL BENZENE	84	116	102
TOTAL XYLENES	92	104	100

DATA REVIEW

10/1/91
cc J.M. Lamm

GSX / R & D MANUFACTURING
TABLE OF ANALYTICAL RESULTS
TOTAL PARTICULATES ($\mu\text{g}/\text{M}^3$)

Filter Number	Field I.D.	Date Sampled	Instrument S/N	Sampling Time (Min)	Average Flow Rate (SCFM)	Particulate Weight (G)	Total Particulate ($\mu\text{g}/\text{M}^3$)
143497	P/M-8-SWD	1-16-91	1527-CAE	61	48.5	0.0046	54.9
143478	P/M-1-SWD	1-12-91	1527-CAE	60	48.5	0.0017	20.6
143494	P/M-5-SEU	1-14-91	1527-CAE	60	48.5	0.0016	19.4
143500	P/M-5B-SEU	1-14-91	1527-CAE	—	—	-0.0010	0.0
143490	P/M-4-SEU	1-14-91	1527-CAE	60	48.5	0.0008	9.7
143497	P/M-3-SEU	1-14-91	1527-CAE	62	48.5	0.0012	14.1
143483	P/M-2-SEU	1-13-91	1527-CAE	63	48.5	-0.0011	0.0
143499	P/M-2B-SEU	1-13-91	1527	—	—	-0.0008	0.0
143496	P/M-8-SED	1-16-91	T001051	61	47.5	0.0131	159.7
143479	P/M-1-SED	1-12-91	T001051	60	47.5	0.0028	34.7
143476	P/M-8B-NWU	1-16-91	31824	—	—	0.0000	0.0
143495	P/M-8-NWU	1-16-91	31824	61	46.75	0.0033	40.9
143498	P/M-1B-NWU	1-12-91	31824	—	—	-0.0006	0.0
143480	P/M-1-NWU	1-12-91	31824	55	46.75	0.0015	20.6
143493	P/M-5-NWD	1-14-91	T001051	60	47.5	0.0088	109.0
143488	P/M-4-NWD	1-14-91	T001051	22	47.5	0.0021	71.0
143496	P/M-3C-NWD	1-14-91	3395	62	51.5	0.0071	78.5
143494	P/M-3-NWD	1-14-91	T001051	62	47.5	0.0087	104.3
143482	P/M-2-NWD	1-13-91	T001051	63	47.5	0.0113	133.4
143492	P/M-5-NED	1-14-91	31824	60.8	46.75	0.0036	44.7
143489	P/M-4-NED	1-14-91	31824	60	46.75	0.0046	57.9
143485	P/M-3-NED	1-14-91	31824	5	46.75	0.0012	181.3
143481	P/M-2-NED	1-13-91	31824	63	46.75	0.0015	18.0

BEST COPY

for the following Pages

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Client/Project Name		Project Location		ANALYSES	
R.C.D. Mfg. Inc.	GSX	Coldax, LA			
Project No.	3246 - 001 - G00	Field Logbook No.		Sample No./Identification	Date
Sampler: (Signature)	1-20-91	Lab Sample Number		Type of Sample	
		Chain of Custody Tape No.		REMARKS	
		363C1, 363C2		Y ₂ X ₀ (1m) RDX	
				10END	
POL-1-SED	1-12-91	1619	• IN NaOH	✓	22.15
POL-1-SED	1-12-91	1618	Triniques	✓	22.15
POL-1-SED	1-12-91	1619		✓	22.4
POL-1C-SED	1-12-91	1619		✓	29.0
POL-1B	1-12-91	1619		✓	40.0
POL-2-SEU	1-13-91	1218		✓	28.0
POL-2-NED	1-13-91	1218		✓	28.6
POL-2-NED	1-13-91	1218	• IN NaOH	✓	29.5
Relinquished by: (Signature)		Date	Time	Received by: (Signature)	
(Signature)		1-15-91	1700		
Relinquished by: (Signature)		Date	Time	Received by: (Signature)	
(Signature)					
Relinquished by: (Signature)		Date	Time	Received for Laboratory: (Signature)	
(Signature)					
Sample Disposal Method:		Date	Time	Disposed of by: (Signature)	
SAMPLE COLLECTOR		ANALYTICAL LABORATORY			
Runs 1 & 2 RDX		Environmental Research and Technology, Inc. 33 Industrial Way Wilmington, MA 01887 617-667-4290			
		ERT			
		No. 25817			

Client/Project Name		Project Location				
R.D. NY	TNT	Colfax, LA				
Project No.	Field Logbook No.					
3246-001	3246					
Sampler (Signature)	Wade					
		Chain of Custody Tape No.				
		36301, 36302				
Sample No./Identification	Date	Time	Lab Sample Number	Type of Sample	REMARKS	
					1-13-91	1218
POL-2B	1-14-91	1012			✓	40.0
POL-3-SEA	1-14-91	1012			✓	29.0
POL-3-NED	1-14-91	1012			✓	28.3
POL-3-NED	1-14-91	1012			✓	29.2
POL-3B	1-14-91	1150			✓	40.0
POL-4-SEA	1-14-91	1342			✓	28.8
POL-4-NED	1-14-91	1342			✓	29.0
POL-4-NED	1-14-91	1342			✓	29.0
Relinquished by: (Signature)		Received by: (Signature)		Date	Time	
Wade		1-15-91		1100		
Relinquished by: (Signature)		Received by: (Signature)		Date	Time	
Wade				1-15-91	1100	
Relinquished by: (Signature)		Received for Laboratory: (Signature)		Date	Time	
Wade				1-15-91	1100	
Sample Disposal Method:		Disposed of by: (Signature)		Date	Time	
TNT				1-15-91	1100	
SAMPLE COLLECTOR		ANALYTICAL LABORATORY		ERT		
Rants		Environmental Research and Technology, Inc.				
364		33 Industrial Way				
TNT		Wilmington, MA 01887				
		617-657-4290				
		Nº 25818				

Client/Project Name		Project Location		ANALYSES	
Mr. D. A. M.	32A6 - Colfax LA	Colfax, LA			
Sample No./ID No.		Field Logbook No.			
32A6 - Colfax LA		32A6 - Colfax LA			
Sampler: (Signature)		Chain of Custody Tape No.		REMARKS	
Sample No./Identification		Date	Time	Type of Sample	Front Back
VOC-28 - T-54		1-15-91	1700	VOST PAIRS	✓
VOC-3 - BEA		1-15-91	1700		✓
VOC-3 - NED					✓
VOC-3 - NUD					✓
VOC-3B - T-64		1-15-91	1012		✓
VOC-4 - T-50		1-15-91	1342		✓
VOC-4 - RIN					✓
VOC-4 - ASD		1-15-91	1342	VOST PAIRS	✓
Relinquished by: (Signature)				Date	Time
(R. Lee)		1-15-91	1700	Received by: (Signature)	
Relinquished by: (Signature)				Date	Time
(R. Lee)				Received for Laboratory: (Signature)	
Relinquished by: (Signature)				Date	Time
(R. Lee)				Disposed of by: (Signature)	
SAMPLE COLLECTOR		ANALYTICAL LABORATORY			
Each Sample ID represents 2 tubes (1 VOST PAIR) Ternax / Tenax Charcoal		Environmental Research and Technology, Inc. 33 Industrial Way Wilmington, MA 01887 617-857-4290			
Runs 3 & 4 TNT		ERT		No. 25829	

CHAIN OF CUSTODY RECORD

Project Name		Project No.		Field Logbook No.		ANALYSES	
RC Dynamics		155X		1035		3C307	
Initials: (Signature)		Initials: (Signature)		Initials: (Signature)		Initials: (Signature)	
Chain of Custody Tape No.		Lab Sample Number		Type of Sample		REMARKS	
Sample No.	Identification	Date	Time	Set of 3 Video Tapes	✓		
1035-1	TNT # 1	1-12-91					
1035-2	TNT # 1	1-13-91					
1035-3	TNT # 2	1-14-91					
1035-4	DET # 1	1-14-91					
1035-5	DET # 2	1-16-91					
1035-6	DET # 3	1-16-91					
1035-7	DET # 4	1-16-91					
1035-8	DET # 5	1-16-91					
1035-9	DET # 6	1-16-91					
1035-10	DET # 7	1-16-91					
1035-11	DET # 8	1-16-91					
1035-12	DET # 9	1-16-91					
1035-13	DET # 10	1-16-91					
1035-14	DET # 11	1-16-91					
1035-15	DET # 12	1-16-91					
1035-16	DET # 13	1-16-91					
1035-17	DET # 14	1-16-91					
1035-18	DET # 15	1-16-91					
1035-19	DET # 16	1-16-91					
1035-20	DET # 17	1-16-91					
1035-21	DET # 18	1-16-91					
1035-22	DET # 19	1-16-91					
1035-23	DET # 20	1-16-91					
1035-24	DET # 21	1-16-91					
1035-25	DET # 22	1-16-91					
1035-26	DET # 23	1-16-91					
1035-27	DET # 24	1-16-91					
1035-28	DET # 25	1-16-91					
1035-29	DET # 26	1-16-91					
1035-30	DET # 27	1-16-91					
1035-31	DET # 28	1-16-91					
1035-32	DET # 29	1-16-91					
1035-33	DET # 30	1-16-91					
1035-34	DET # 31	1-16-91					
1035-35	DET # 32	1-16-91					
1035-36	DET # 33	1-16-91					
1035-37	DET # 34	1-16-91					
1035-38	DET # 35	1-16-91					
1035-39	DET # 36	1-16-91					
1035-40	DET # 37	1-16-91					
1035-41	DET # 38	1-16-91					
1035-42	DET # 39	1-16-91					
1035-43	DET # 40	1-16-91					
1035-44	DET # 41	1-16-91					
1035-45	DET # 42	1-16-91					
1035-46	DET # 43	1-16-91					
1035-47	DET # 44	1-16-91					
1035-48	DET # 45	1-16-91					
1035-49	DET # 46	1-16-91					
1035-50	DET # 47	1-16-91					
1035-51	DET # 48	1-16-91					
1035-52	DET # 49	1-16-91					
1035-53	DET # 50	1-16-91					
1035-54	DET # 51	1-16-91					
1035-55	DET # 52	1-16-91					
1035-56	DET # 53	1-16-91					
1035-57	DET # 54	1-16-91					
1035-58	DET # 55	1-16-91					
1035-59	DET # 56	1-16-91					
1035-60	DET # 57	1-16-91					
1035-61	DET # 58	1-16-91					
1035-62	DET # 59	1-16-91					
1035-63	DET # 60	1-16-91					
1035-64	DET # 61	1-16-91					
1035-65	DET # 62	1-16-91					
1035-66	DET # 63	1-16-91					
1035-67	DET # 64	1-16-91					
1035-68	DET # 65	1-16-91					
1035-69	DET # 66	1-16-91					
1035-70	DET # 67	1-16-91					
1035-71	DET # 68	1-16-91					
1035-72	DET # 69	1-16-91					
1035-73	DET # 70	1-16-91					
1035-74	DET # 71	1-16-91					
1035-75	DET # 72	1-16-91					
1035-76	DET # 73	1-16-91					
1035-77	DET # 74	1-16-91					
1035-78	DET # 75	1-16-91					
1035-79	DET # 76	1-16-91					
1035-80	DET # 77	1-16-91					
1035-81	DET # 78	1-16-91					
1035-82	DET # 79	1-16-91					
1035-83	DET # 80	1-16-91					
1035-84	DET # 81	1-16-91					
1035-85	DET # 82	1-16-91					
1035-86	DET # 83	1-16-91					
1035-87	DET # 84	1-16-91					
1035-88	DET # 85	1-16-91					
1035-89	DET # 86	1-16-91					
1035-90	DET # 87	1-16-91					
1035-91	DET # 88	1-16-91					
1035-92	DET # 89	1-16-91					
1035-93	DET # 90	1-16-91					
1035-94	DET # 91	1-16-91					
1035-95	DET # 92	1-16-91					
1035-96	DET # 93	1-16-91					
1035-97	DET # 94	1-16-91					
1035-98	DET # 95	1-16-91					
1035-99	DET # 96	1-16-91					
1035-100	DET # 97	1-16-91					
1035-101	DET # 98	1-16-91					
1035-102	DET # 99	1-16-91					
1035-103	DET # 100	1-16-91					
1035-104	DET # 101	1-16-91					
1035-105	DET # 102	1-16-91					
1035-106	DET # 103	1-16-91					
1035-107	DET # 104	1-16-91					
1035-108	DET # 105	1-16-91					
1035-109	DET # 106	1-16-91					
1035-110	DET # 107	1-16-91					
1035-111	DET # 108	1-16-91					
1035-112	DET # 109	1-16-91					
1035-113	DET # 110	1-16-91					
1035-114	DET # 111	1-16-91					
1035-115	DET # 112	1-16-91					
1035-116	DET # 113	1-16-91					
1035-117	DET # 114	1-16-91					
1035-118	DET # 115	1-16-91					
1035-119	DET # 116	1-16-91					
1035-120	DET # 117	1-16-91					
1035-121	DET # 118	1-16-91					
1035-122	DET # 119	1-16-91					
1035-123	DET # 120	1-16-91					
1035-124	DET # 121	1-16-91					
1035-125	DET # 122	1-16-91					
1035-126	DET # 123	1-16-91					
1035-127	DET # 124	1-16-91					
1035-128	DET # 125	1-16-91					
1035-129	DET # 126	1-16-91					
1035-130	DET # 127	1-16-91					
1035-131	DET # 128	1-16-91					
1035-132	DET # 129	1-16-91					
1035-133	DET # 130	1-16-91					
1035-134	DET # 131	1-16-91					
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1035-136	DET # 133	1-16-91					
1035-137	DET # 134	1-16-91					
1035-138	DET # 135	1-16-91					
1035-139	DET # 136	1-16-91					
1035-140	DET # 137	1-16-91					
1035-141	DET # 138	1-16-91					
1035-142	DET # 139	1-16-91					
1035-143	DET # 140	1-16-91					
1035-144	DET # 141	1-16-91					
1035-145	DET # 142	1-16-91					
1035-146	DET # 143	1-16-91					
1035-147	DET # 144	1-16-91					
1035-148	DET # 145	1-16-91					
1035-149	DET # 146	1-16-91					
1035-150	DET # 147	1-16-91					
1035-151	DET # 148	1-16-91					
1035-152	DET # 149	1-16-91					
1035-153	DET # 150	1-16-91					
1035-154	DET # 151	1-16-91					
1035-155	DET # 152	1-16-91					
1035-156	DET # 153	1-16-91					
1035-157	DET # 154	1-16-91					
1035-158	DET # 155	1-16-91					
1035-159	DET # 156	1-16-91					
1035-160	DET # 157	1-16-91					
1035-161	DET # 158	1-16-91					
1035-162	DET # 159	1-16-91					
1035-163	DET # 160	1-16-91					
1035-164	DET # 161	1-16-91					
1035-165	DET # 162	1-16-91					
1035-166	DET # 163	1-16-91					
1035-167	DET # 164	1-16-91					
1035-168	DET # 165	1-16-91					
1035-169	DET # 166	1-16-91					
1035-170	DET # 167	1-16-91					
1035-171	DET # 168	1-16-91					
1035-172	DET # 169	1-16-91					
1035-173	DET # 170	1-16-91					
1035-174	DET # 171	1-16-91					
1035-175	DET # 172	1-16-91					
1035-176	DET # 173	1-16-91					
1035-177	DET # 174	1-16-91					
1035-178	DET # 175	1-16-91					
1035-179	DET # 176	1-16-91					
1035-180	DET # 177	1-16-91					
1035-181	DET # 178	1-16-91					
1035-182	DET # 179	1-16-91					
1035-183	DET # 180	1-16-91					
1035-184	DET # 181	1-16-91					
1035-185	DET # 182	1-16-91					

Project Vacation

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CHAIN OF CUSTODY RECORD

Client/Project Name	Project Location	ANALYSES													
		Field Sample No.			Chain of Custody Tape No.			Lab Sample Number			Type of Sample			REMARKS	
Sample No./Identification	Date	Time	Field Sample No.	Chain of Custody Tape No.	Lab Sample Number	Lab Sample No.	Chain of Custody Tape No.	Lab Sample Number	Type of Sample	Type of Sample	Type of Sample	Date	Time	Date	Time
TNT-3-SEA	1-14-91	10:14							Pur + Filter	Pur + Filter	Pur + Filter				
TNT-3-SEA	11	11													
TNT-3-NED	11	9:17													
TNT-4-SEA	11	13:42													
TNT-4-NED	11	13:42													
TNT-4-NED	11	13:42													
Relinquished by: (Signature)				Received by: (Signature)				Received by: (Signature)				Received for Laboratory: (Signature)			
Relinquished by: (Signature)				Date	Time	Received by: (Signature)				Date	Time	Received for Laboratory: (Signature)			
Relinquished by: (Signature)				Date	Time	Received by: (Signature)				Date	Time	Received for Laboratory: (Signature)			
Sample Disposal Method:							Disposed of by: (Signature)				Date	Time			
SAMPLE COLLECTOR Name	3 & 4 TNT Burns			ANALYTICAL LABORATORY			ERT			Environmental Research and Technology, Inc.					
TRIP BLANK - TNT	1-15-91												33 Industrial Way Wilmington, MA 01887 617-857-4290		
No. 25821															

URAIN EFCU

Project Location

Name

KED M1

Date

1974

Year

1974

Month

July

Day

16

Year

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CHAIN OF CUSTODY RECORD

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SAMPLE COLLECTOR

ANALYTICAL LABORATORY

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25834

Environmental Research and Technology, Inc.
33 Industrial Way
Wilmington, MA 01887
617-657-4290

CHAIN OF CUSTODY

Project Location

Field Logbook No.

Chain of Custody Type No.
CH-1-2440

ANALYSES

REMARKS

Sample

Type

Date

Time

Date

CHAIN OF CUSTODY RECORD

Name	Project Location	ANALYSES												
John D. W.	Coffee LA													
Date Sampled	Field Notebook No.													
10/4/1984	1041640													
Signature	Signature													
Chain of Custody	Type No.	Type of Sample	Received by:			Received for Laboratory:			Disposed of by:			Comments		
Number			Date	Time	Signature	Date	Time	Signature	Date	Time	Signature	Date	Time	Signature
1002	X427	8x10 Filter	✓	✓										
1003	S-N60		✓	✓										
1004	C-S64		✓	✓										
1005			✓	✓										
1006			✓	✓										
1007			✓	✓										
1008			✓	✓										
1009			✓	✓										
1010			✓	✓										
1011			✓	✓										
1012			✓	✓										
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1014			✓	✓										
1015			✓	✓										
1016			✓	✓										
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1149			✓	✓										
1150			✓	✓										

12:00:01 0013 01 P&D MFG. 01/13/90

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	01	02	03	
CHAN	TEMP	-DIP	-PPD	SDI
UNITS	DEG-F	DEG	MPH	DEG
FSCALE	122.0	360.0	100.0	99.9
ZERO	+22.0	0.0	0.0	00.0

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11:05	44.4	185.2	4.2	85.9
11:10	44.3	169.9	4.9	87.2
11:15	44.3	193.9	4.3	81.8
11:20	44.9	169.6	4.8	84.9
11:25	44.7	177.8	4.7	85.4
11:30	45.6	157.9	3.2	49.4
11:35	45.8	163.6	3.7	34.2
11:40	45.4	185.2	4.0	22.8
11:45	46.4	186.1	3.4	31.4
11:50	46.2	178.2	3.6	27.2
11:55	46.3	193.9	4.0	25.6
12:00	47.1	179.3	4.0	43.6

#2

RDX
Run #2

13:00:01 0013 01 P&D MFG. 01/13/90

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	01	02	03	
CHAN	TEMP	-DIP	-PPD	SDI
UNITS	DEG-F	DEG	MPH	DEG
FSCALE	122.0	360.0	100.0	99.9
ZERO	+22.0	0.0	0.0	00.0

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12:05	47.4	151.9	3.2	89.8
12:10	46.7	161.1	3.6	41.8
12:15	47.3	155.0	3.2	65.3
12:20	48.6	188.9	3.2	55.3
12:25	48.2	191.1	3.6	55.7
12:30	47.3	186.1	3.4	81.8
12:35	48.4	211.1	3.6	75.1
12:40	48.9	182.9	4.5	55.0
12:45	48.7	200.9	3.2	42.4
12:50	48.7	126.1	3.4	45.2
12:55	48.2	176.9	3.8	55.3
13:00	48.7	149.0	3.6	44.7

10:00:01 0014 01 R&D 476. 01/14/90

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	01	02	03	
CHAN	TEMP	V-DIR	V-SPD	DDI
UNITS	DEG-F	DEG	KPH	DEG
FSL	122.0	360.0	00.0	99.9
ZERO	-22.0	0.0	0.0	00.0

=====

08:05 48.6 149.4 4.1 61.2

08:10	48.6	146.2	5.1	58.4
08:15	48.9	149.9	5.4	52.7
08:20	48.1	149.9	5.1	53.4
08:25	48.3	150.1	5.4	54.3
08:30	47.7	151.1	5.1	51.1
08:35	44.4	148.9	5.8	29.6
08:40	45.0	140.0	5.4	31.3
08:45	45.5	153.2	5.8	33.1
08:50	45.8	144.8	5.8	31.3
08:55	46.5	152.1	5.5	37.3
09:00	47.4	137.2	4.0	22.7

#3

TNT
Run # 1

11:00:01 0014 01 R&D 476. 01/14/90

=====

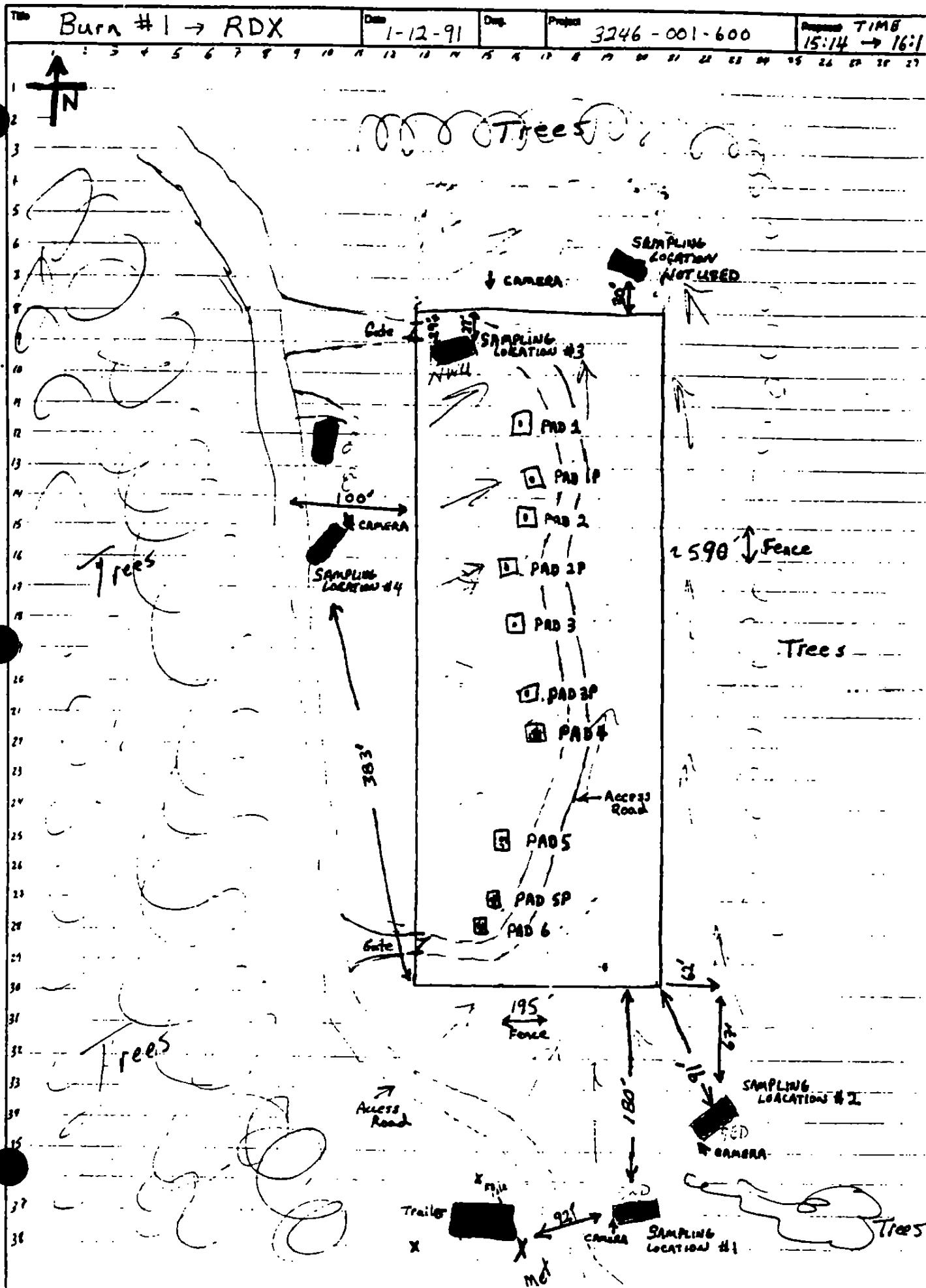
	01	02	03	
CHAN	TEMP	V-DIR	V-SPD	DDI
UNITS	DEG-F	DEG	KPH	DEG
FSL	122.0	360.0	00.0	99.9
ZERO	-22.0	0.0	0.0	00.0

=====

10:05 49.4 157.9 3.6 24.3

10:10	49.2	140.9	4.0	27.3
10:15	48.2	139.0	5.8	24.7
10:20	48.1	136.8	5.8	21.0

10:25	48.7	152.1	5.8	25.6
10:30	49.3	153.2	4.8	20.5
10:35	49.7	145.1	5.1	20.9
10:40	49.7	146.9	5.6	23.0
10:45	50.2	149.9	5.8	25.2
10:50	51.0	154.8	5.4	28.1
10:55	51.5	139.9	4.9	26.1
11:00	52.1	137.2	5.9	26.0



16:00:01 0012 01 R&D MFG. 01/12/90

CHAN	TEMP	V-DIR	V-SPD	SD1
UNITS	DEG-F	DEG	KPH	DEG
FSCL	122.0	360.0	100.0	99.9
ZERO	-22.0	0.0	0.0	00.0

15:05	46.1	319.9	4.7	41.6
15:10	45.7	335.3	3.0	55.7
15:15	46.5	313.4	3.2	41.6
15:20	46.4	305.8	3.5	55.9
15:25	46.5	310.9	3.8	43.7
15:30	46.6	277.2	3.0	33.0
15:35	46.7	291.8	3.0	60.6
15:40	46.9	273.8	2.8	61.5
15:45	46.3	294.3	3.9	37.6
15:50	46.1	294.8	4.4	33.8
15:55	46.4	264.2	4.0	43.5
16:00	46.1	320.4	3.2	37.4

RDX
Run #1

*1

17:00:01 0012 01 R&D MFG. 01/12/90

CHAN	TEMP	V-DIR	V-SPD	SD1
UNITS	DEG-F	DEG	KPH	DEG
FSCL	122.0	160.0	100.0	99.9
ZERO	-22.0	0.0	0.0	00.0

16:05	45.9	325.8	5.3	35.0
16:10	45.6	346.9	5.2	19.7
16:15	45.3	339.8	5.3	18.1
16:20	45.3	340.4	5.0	18.5
16:25	45.3	345.4	5.1	14.3
16:30	45.3	345.4	5.3	12.9
16:35	45.1	336.1	5.0	22.3
16:40	44.9	341.3	4.7	15.0
16:45	44.9	331.4	5.2	15.1
16:50	44.6	332.8	5.1	15.6
16:55	44.0	335.0	4.5	18.4
17:00	43.7	303.0	2.8	24.4

SAMPLE DATA SHEET

DATE: 1-12-51

CLIENT: Red Mfg. Inc.

PROJECT: 3240 - CCI - GCO

OPERATOR: SC-21 LP

RUN #: 1
LOCATION: Selfax, LA

AMBIENT TEMP (F): 38°

TIME: 1120

BAROMETRIC PRESS. (IN HG): 30.27

RDX # 1

SAMPLE ID#	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME	Avg. STD. FLOW RATE (ml/min.)	TOTAL VOL. (liters)	ANALYTICAL RESULT
VOC-1-NAW	WEST PAIR	Uni SW	11C25	1614	1619	60	1645.2	62.64	
Pol-1-NAW	IMP	Uni SW	C.9724			60	1641.1	69.44	
VOC-IR-NW	WEST PAIR					60	c.	c.	Final
VOC-1-SWD	WEST PAIR	Dw SW	10C27			60	1643.0	68.10	
Pol-1-SWD	IMP	Dw SW	10C28			60	1645.8	64.31	
Pol-1-SED	IMP	Dw SE	01C11			60	1648.8	69.55	
VOC-1-SED	WEST PAIR	Dw SE	10C23			60	1640.2	70.21	
Pol-1-SED	IMP	Dw SE	10C22			60	1621.9	67.34	
VOC-SC-SED	WEST PAIR	Dw SE	10D30	1614	1619	60	1645.7	64.18	
Pol-1-B	Boat & Neck		(1-9-91)	1619			c.	c.	

ON UFC 1518 / 1424

Burn #2 → RDX

(-13-9)

1

3246-001-600

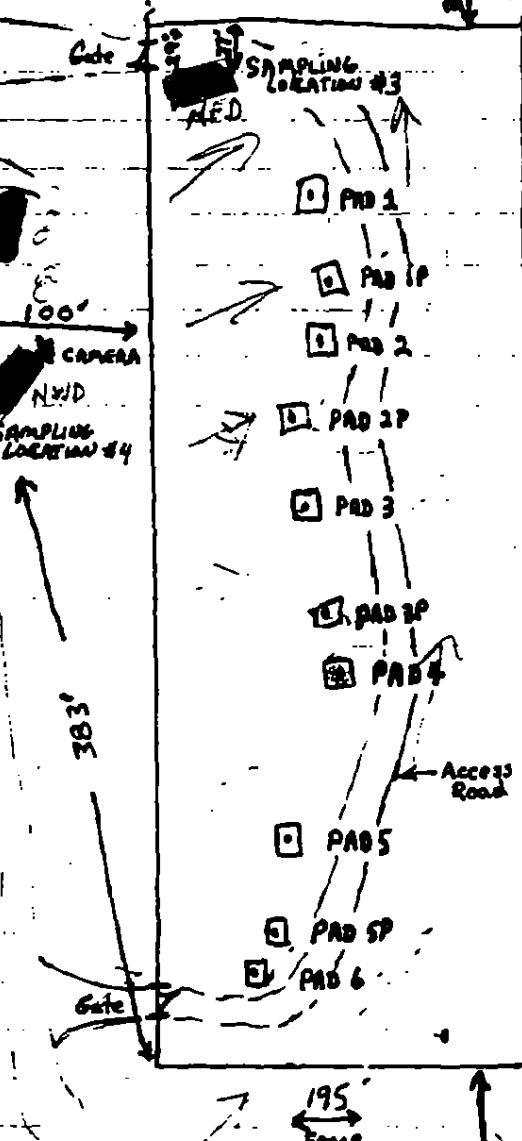
TIME
8-13:21



Mr. Trees

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16 trees
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32 trees

A hand-drawn map on graph paper showing two sampling locations. At the top, a horizontal line is labeled "Gate 1". Below it, a vertical line is labeled "Gate 2". A black rectangle representing a camera is positioned between the two gates. A horizontal arrow points from the camera towards Gate 2, with the text "100'" written above it. To the right of the camera, the text "CAMERA" and "N.W.D." are written vertically. Below the camera, the text "SAMPLING LOCATION #4" is written. A curved arrow points downwards from the camera area. To the right of this arrow, the text "383°" is written vertically. At the bottom, another horizontal line is labeled "Gate 3".



PUSH
LOCATION
NOT USED

2590' ↓ Fence

Tree

SAMPLING
LOCATION #2

卷之三

— 1 —

Hand-drawn map showing the location of a sampling site. A black rectangle labeled "Trailer" has an "X" above it labeled "spill". An arrow points from "spill" to a point labeled "SEU". Another arrow points from "SEU" to a point labeled "PANNE". A curved line labeled "C" starts at "PANNE" and ends at "Sampling Location #1". The label "NO" is written below the "Trailer" rectangle.

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8

RDX
703 303 AL
Bursts
11 x 10/bs

DATE: 1-12-91

CLIENT: R&D Mfg. Inc.

PROJECT: 32460-001-5000

OPERATOR: SW/LP

RUN #: 1
LOCATION: Colfax, WI
AMBIENT TEMP (F): 38 TIME: 1120
BAROMETRIC PRESSURE (in Hg) 30.27

SAMPLE DATA SHEET

DATA

SAMPLE ID	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME	AVG. STD. FLOW RATE	TOTAL VOL	ANALYTIC RESULT	
									(To top column)	(Total time)
SED P1A-1-SED	Filter 8x10	DW SE	Tool 051	15:19	15:19	0 min	47.50 scfm	2.950 scfm	3:18	Bu
RDX-1-SED			19733	15:24	16:22	60 min	47.25 scfm	2835 scfm	Pad 3	
PAH-1-SED			Tool 001				50.25 scfm	3045 scfm	1:24	Bu
PAH-10-SED			33950				51.50 scfm	3090 scfm	Pad 6	
SWD Rdx-1-SED	Filter 8x10	DW SW	1523				48.50 scfm	2910 scfm	3:32	Bu
RDX-1-SED			1582				47.00 scfm	2820 scfm	Pad 3P	
PAH-1-SED			1523				45.25 scfm	2715 scfm	Pad 5P	
SWD Rdx-1-SED	Filter 8x10	11W NW	31824	16:17	16:17	0 min	46.75 scfm	2.971 scfm	3:50	Bu
RDX-1-SED			Tool 2003				47.50 scfm	2613 scfm	Pad 5	
PAH-1-SED							47.50 scfm	2613 scfm	Pad 6	
RDX-1-BURST			17162						3:38	Bur
PAH-1-BURST									Pad 5P	
RDX-1-BURST									4:03	Bur
PAH-1-BURST									Pad 5	
									4:07	Bur
									Pad 4	
									4:09	Bur
									Pad 3	

Stopped at 15:19
Restarted at 15:24

SAMPLE DATA SHEET

DATE: 1-13-21

CLIENT : B&D MFG INC.

ANSWER: $\frac{3249 - C_1 - C_2}{3}$

CEBALLOS / 169

RUN #: 2 LOCATION: CE/Fax

A
TEX
CC

A HISTORY

AMBIENT TEMP (F): 54 TIME: C83C1

THE ECONOMICS OF INVESTMENT

BROWNE / WIGLIANSKI // 11

TDX #2

卷之三

LYNICAL

ANALYTICAL RESULT								1
SAMPLE ID#	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME STATION	END TIME STATION	AVG. STD. FLOW RATE (ml/min)	TOTAL VOL (ml)	1
WCE-2-SEN	Imp	{ Upwind }	01911	11:48 (11)	12:18	3.05	1.014	10.042
WCE-2-SEN	VOST		10025	11:18	12:18	6.0	1.7	16.202
WCE-2-NWD	Imp	{ Downwind }	06008	11:18	12:18	6.817		
WCE-2-NWD	VOST		10023	11:48	12:18	6.57	1	12.446
WCE-2-NED	Imp	{ Downwind }	09174	11:18	12:18	11.57	0.1	68.672
WCE-2-NED	VOST		10027	11:18	12:18	11.81	0.1	10.815
WCE-2-B-SEN	VOST	{ Ground }	1118	12:18	6.0	0	0	Field Blank
WCE-2-B-SEN	VOST		1218			0	0	Reagent Blank
WCE-2-B-SEN	VOST		1218			0	0	Standby

Burn #3 → TNT

1-14-91

Days

Project

3246-001-600

TIME
09:12 → 10:14



100' Trees

↓ Camera

SAMPLING
LOCATION
NOT USED

Gate

SAMPLING
LOCATION #3

NED

PAD 1

PAD 1P

PAD 2

PAD 2P

PAD 3

PAD 3P

PAD 4

PAD 5

PAD 5P

PAD 6

Access
Road

383

2590' ↓ Fence

Trees

Gate

195'
Fence

Access
Road

Trailer

X

93'

Fence

X

SEU

No

SAMPLING
LOCATION #1

Trees

DATE: 1-14-91

Run #: 3

卷之三

client : ~~ESF/RED/MFG~~

Burgess and Webb measure: 3246-001-600
Burgess and Webb orientation: 49°/54°

LOCATION: Calfax Lat 21°12'

AMBIENT TEMP (F): 82.6 TIME: 9:12

BAROMETRIC PRESSURE (IN Hg) 30.18

LOCATION: Columbia

AMBIENT TEMP (F): 62.6 TIME:

BAROMETRIC PRESSURE

SAMPLE ID	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME	AVG. STD. FLOW RATE (SCFM)	TOTAL VOL.	ANALYTICAL RESULT	
									(Total Volume)	(1 Total Volume)
PAH-3-AW	8x10 Filter	Downdraft Bldw	33950	9:12	10:14	1:12	51.50 SCFM	3193 SCFM		
PAH-3-AWD			7001051				47.50 SCFM	2945 SCFM		
PAH-3-HWD			7001001				50.25 SCFM	3142 SCFM		
PAH-3-AWD	Puf & Filter		32122				255 SCFM	15,810 SCFM		
PAH-3-SEED	Puf & Filter		32262	✓	✓	✓	255 SCFM	15,810 SCFM		
PAH-3-SEED	8x10 Filter	Downdraft Bldw	31824	9:12	9:17	5:12	46.75 SCFM	234 SCFM		
PAH-3-SEED	"		17167				42.50 SCFM	238 SCFM		
PAH-3-SEED	Puf & Filter		31914	✓	✓	✓	26.5 SCFM	1,325 SCFM		
PAH-3-SEED	8x10 Filter	Upwind SE	1527	9:12	10:19	1:11	48.50 SCFM	3007 SCFM		
PAH-3-SEED	"		1523				45.25 SCFM	2806 SCFM		
PAH-3-SEED	Puf & Filter		160205	✓	✓	✓	266 SCFM	16,492 SCFM		
PAH-3-SEED	Puf & Filter	upwind SE	162205	Field Blank						

SAMPLE D SHEET

i - 14 - 51

DATE: 1-13-05

Red Mfg., Inc.

PROBLEMS

卷之三

OPERATOR: Skarib

RUN #: 3 LOCATION: Colfax 6A

LOCATION: Colfax, LA

AMBIENT TEMP (°F): _____ TIME: _____

BACOMETRIC AREA (S)

RUN #: 3

LOCATION: Colfax

AMBIENT TEMP (°F):

BIBLIOGRAPHIC REFERENCES

十一

Burn #4 → TNT

Date 1-14-91

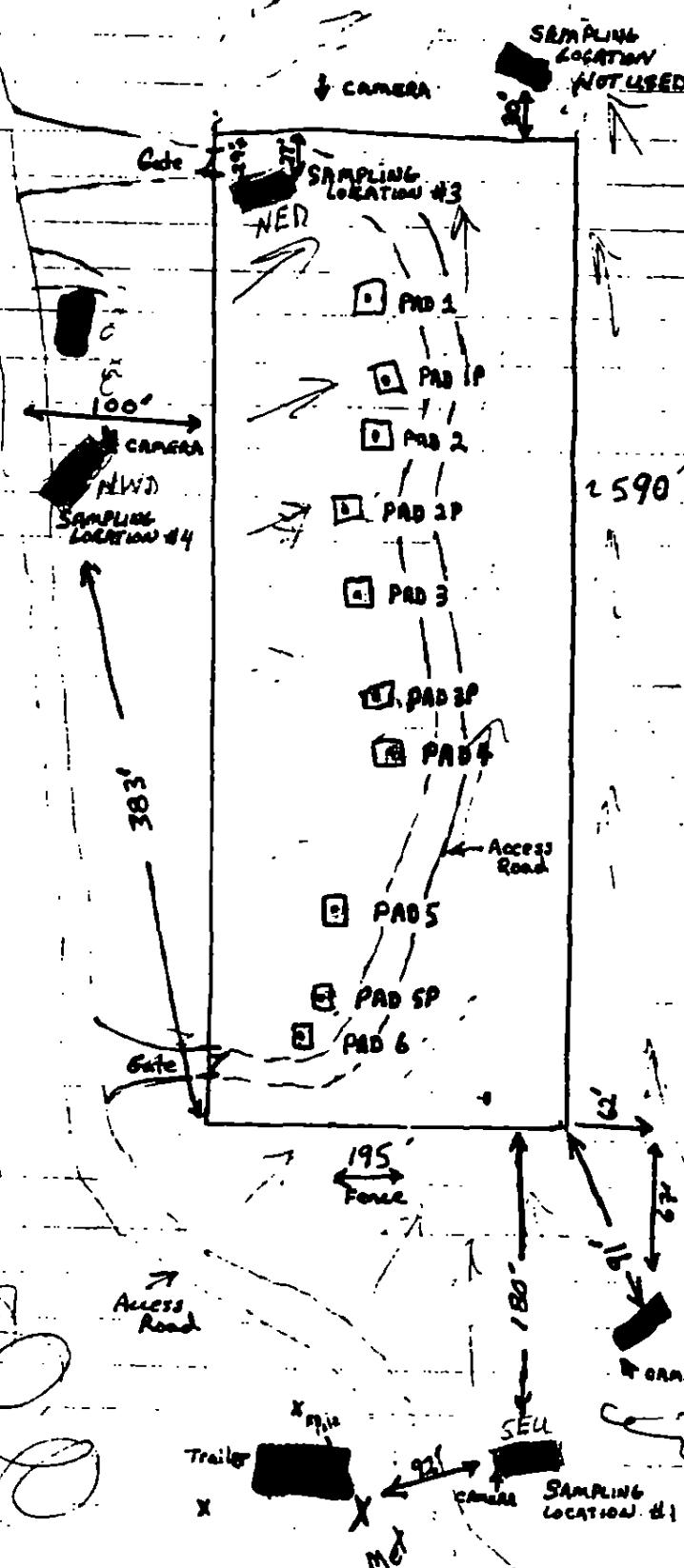
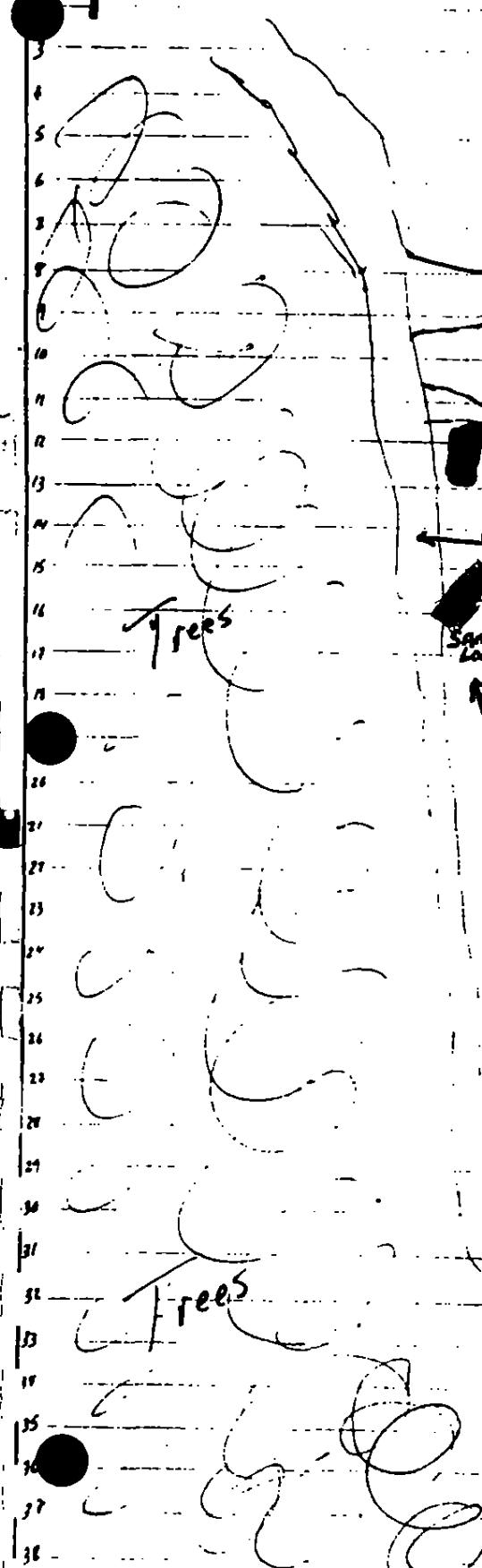
Day

Period

3246-001-600

TIME
12:42 → 13:42

100' Trees



13:00:01 0014 01 R&D MFG. 01/14/90

	01	02	03	
CHAN	TEMP	V-DIR	V-SPD	T21
UNITS	DEG-F	DEG	MPH	DEG
FSCL	1.000.0	260.0	100.0	99.9
ZERO	-22.0	0.0	0.0	00.0

12:05	56.	144.9	5.0	22.7
12:10	56.8	143.8	4.9	21.8
12:15	57.5	139.9	4.6	20.2
12:20	59.7	135.6	4.6	20.7
12:25	57.9	156.1	5.6	21.7
12:30	57.7	130.1	5.5	20.7
12:35	59.8	135.9	5.5	21.3

12:40	59.7	119.0	6.4	10.0
12:45	57.7	162.5	6.6	11.1
12:50	57.8	151.0	6.6	10.5
12:55	59.2	142.0	6.1	14.1
13:00	58.8	141.1	6.0	11.8

14:00:01 5014 01 260 075, 111-14290

	9.	93	91	100
CHAN	TEMP	-618	-622B	120
UNITS	DEG-F	DEG	DEG	DEG
FLOOR	122.0	150.0	100.0	98.0
ZERO	-32.0	0.0	0.0	36.0

13:05	59.3	136.3	4.5	23.4	
13:10	59.2	149.1	5.3	27.0	
13:15	59.4	142.0	4.9	23.6	
13:20	57.1	150.8	5.4	22.4	
13:25	57.1	158.9	5.5	21.4	
13:30	57.6	134.1	5.6	23.8	
13:35	59.5	109.1	4.6	27.2	
13:40	58.7	126.1	4.6	23.0	
13:45	59.4	145.1	4.6	25.5	
13:50	58.2	155.2	5.8	23.3	
13:55	57.7	146.9	6.1	22.7	
14:00	59.0	143.1	4.8	25.2	

4

TNT
R_{min} = 2

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3

Burn # 5 → Detonators

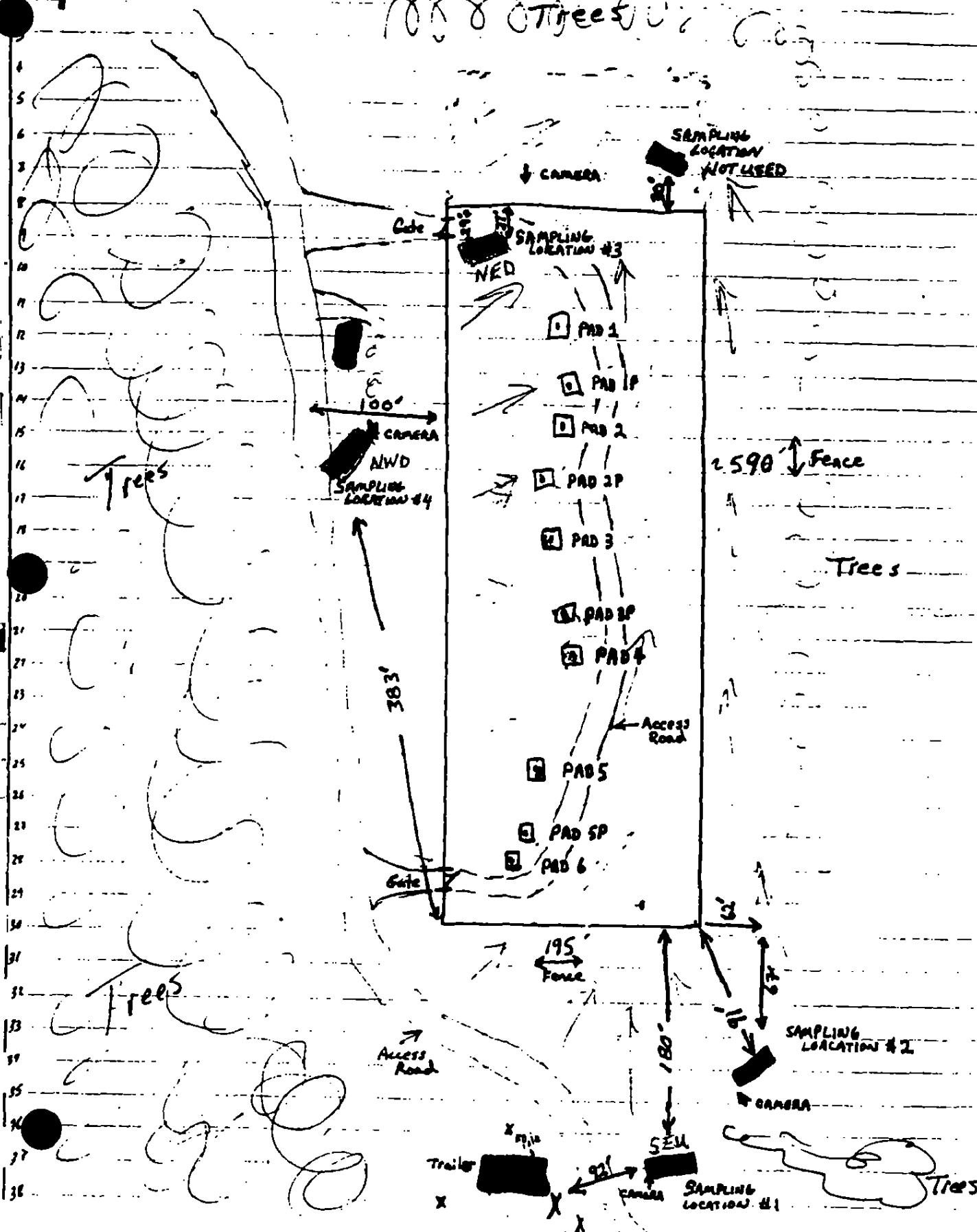
1-14-91

Page

3246-001-600

TIME
15:45 → 16:45

M00 Trees



16:00:01 0014 01 R&D MFG. 01/14/90

=====♦♦♦♦♦

	01	02	03	
CHAN	TEMP	W-DIR	V-SPD	SDI
UNITS	DEG-F	DEG	MPH	DEG
FSCL	122.0	360.0	100.0	99.9
ZERO	-22.0	0.0	0.0	00.0

=====♦♦♦♦♦

15:05	59.7	147.1	5.0	26.3
15:10	59.8	148.8	5.9	20.9
15:15	59.6	146.2	5.9	20.2
15:20	59.7	130.9	5.4	24.9
15:25	59.8	155.1	4.9	28.8
15:30	57.9	150.8	5.4	21.6
15:35	59.0	149.0	5.6	21.2
15:40	59.9	135.8	5.0	21.9
15:45	58.5	137.2	4.0	26.6
15:50	57.8	148.1	4.5	28.9
15:55	57.9	146.2	3.8	31.2
16:00	57.7	144.2	5.6	21.2

DETTONATORS

* 1

5

17:00:01 0014 01 R&D MFG. 01/14/90

=====♦♦♦♦♦

	01	02	03	
CHAN	TEMP	W-DIR	V-SPD	SDI
UNITS	DEG-F	DEG	MPH	DEG
FSCL	122.0	360.0	100.0	99.9
ZERO	-22.0	0.0	0.0	00.0

=====♦♦♦♦♦

16:05	57.7	152.1	5.0	19.9
16:10	57.7	142.9	4.9	25.0
16:15	57.6	142.0	5.1	24.0
16:20	57.2	144.2	4.3	21.7
16:25	57.3	148.1	4.0	25.1
16:30	57.9	135.1	4.6	23.8
16:35	57.5	131.9	4.0	24.5
16:40	57.0	135.8	4.4	26.6
16:45	56.6	142.0	4.1	32.0
16:50	56.3	143.1	3.5	21.9
16:55	56.1	143.1	3.6	25.7
17:00	55.9	147.1	3.4	22.5

SAMPLE DATA SHEET

0.19 lbs
Lond
A21de
Burcas
De Long's

DATE: 1-14-91
CLIENT: GSX / RID MFG
PROJECT: 3246-001-680
OPERATOR: LP/SW

5

RUN #: 15
LOCATION: Colfax, LA
AMBIENT TEMP (F): 58.5 TIME: 15:45
BAROMETRIC PRESSURE (IN Hg) 29.99

SAMPLE ID	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME	AVG STD. FLOW RATE	TOTAL VOL	ANALYTICAL RESULT
PAH-SW1	Stainless Filter	DW NW	1545	1545	16:45	1 hour			① 15:45 Location A
PAH-SW2		Tagool		60	56.75 sec				② 15:45 Location B
PAH-SW3		X	7001051	60	47.50 sec				③ 15:45 Location C
PAH-S-NED	DW NE	17167		60	47.50 sec				④ 16:04 Location D
PAH-S-NED		X	31824	60	46.75 sec				
PAH-S-SE1	UW SE	152344		60	45.75 sec				⑤ 16:14 Location E
PAH-S-SE2		X	152744	60	48.50 sec				⑥ 16:14 Location F
PAH-SB-SW1	Stainless Filter	UW SE	1523142						⑦ 16:30 Location G
PAH-SB-SW2		X	1522142						

Field Blank CD

Field Blank CD

Field Blank CD

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3

SAMPLE DATA SHEET

DATE : ١٤-٩-٢٠٢٣
CLIENT : كلايتون Time
PROJECT : سيارات - توك توك
OPERATOR : سليمان LP

RUN #: 5 LOCATION: Culpeper LA AMBIENT TEMP (F): 58 TIME: 1400 BAROMETRIC PRESS: 30.05 Hg

Lesson Azizie #1

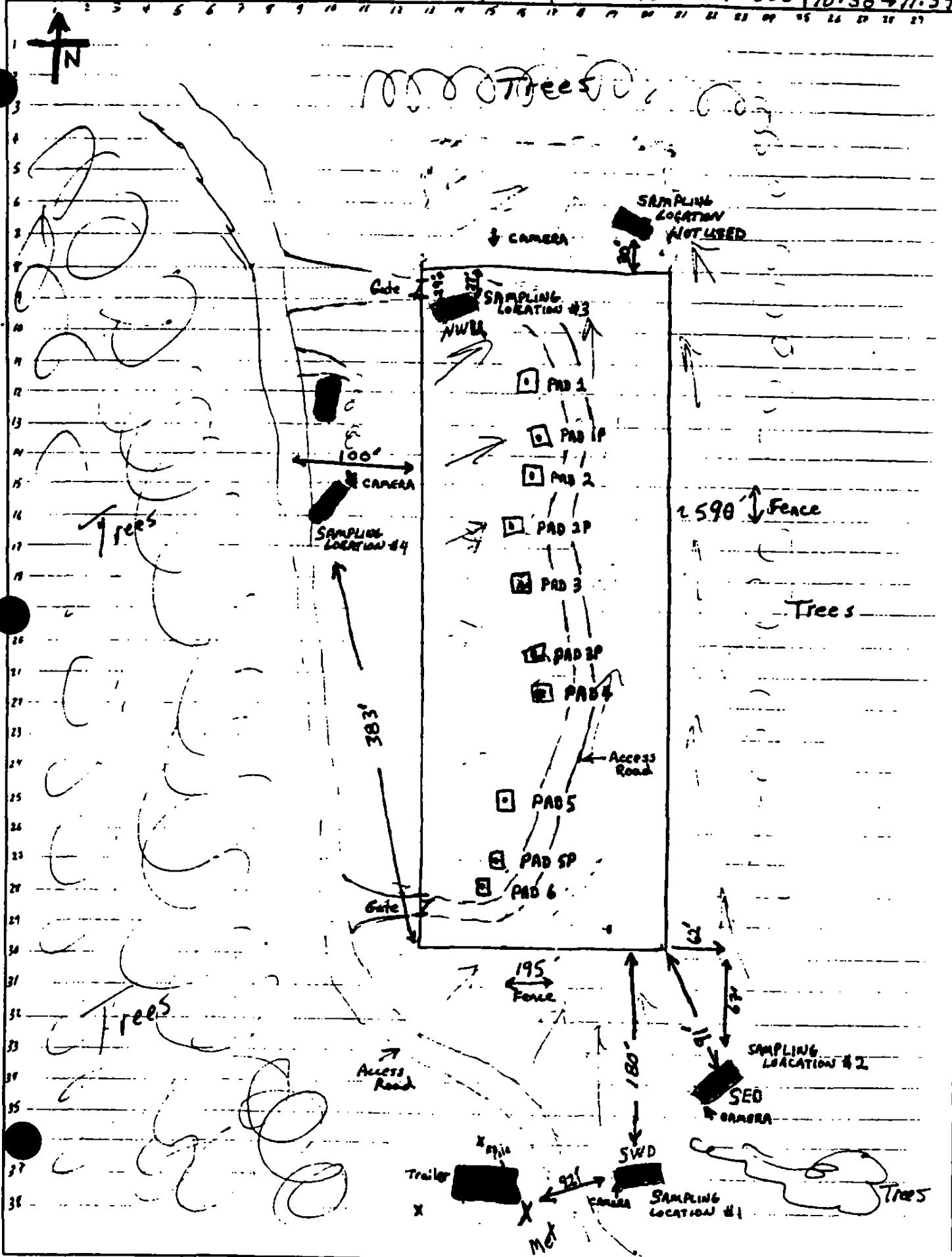
SAMPLE ID	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME	AVG. STD. FLOW RATE	TOTAL VOL (liters)	ANALYTICAL RESULT	
									(cc/min)	(liters)
PCU-5-NED	Trip	Liposomal	C9111	1545	1645	60	11.487	1.8422		
PCU-5-NED	Visit	/	C9108	/	/	/	10.910	1.6143		
PCU-5-NED	Trip	Liposomal	C9124	/	/	/	11.556	1.6544		
PCU-5-NED	Visit	/	16025	/	/	/	11.819	1.6743		
PCU-5-NED	Trip	Liposomal	16021	1545	1645	60	11.221	1.6248		
PCU-5-NED	Visit	/	16020	—	—	—	11.220	1.6234		
PCU-5-NED	Trip	Liposomal	16021	1545	1645	60	11.221	1.6248		
PCU-5-NED	Visit	/	16020	—	—	—	11.220	1.6234		
PCU-1-TB	Trip	Liposomal	16020	1545	1645	60	11.220	1.6234		
PCU-1-TB	Visit	/	16020	—	—	—	11.220	1.6234		

Burn #6 → Detonators

1-16-91

3246-001-600

TIME
10:38 → 11:39



11:00:01 0016 01 R&D MFG. 01/16/90

=====+••••+

CHAN	TEMP	W-DIR	W-SPD	DB1
UNITS	DEG-F	DEG	MPH	DEG
FSCALE	122.0	360.0	100.0	99.9
ZERO	-32.0	0.0	0.0	00.0

=====+••••+

10:05	50.4	332.8	4.0	21.0
10:10	50.5	337.0	4.6	24.3
10:15	50.5	337.0	4.1	17.7
10:20	51.5	342.2	2.6	35.0
10:25	51.7	331.4	4.3	21.8
10:30	52.0	325.8	2.4	23.8

10:35	52.0	333.4	6.3	30.1
10:40	51.5	346.9	6.1	32.3
10:45	52.4	315.4	4.9	33.4
10:50	52.5	333.9	6.7	20.2
10:55	53.6	307.8	4.6	39.9
11:00	53.6	316.3	4.2	22.1

•

DETONATORS

#2

#6

12:00:01 0016 01 R&D MFG. 01/16/90

=====+••••+

CHAN	TEMP	W-DIR	W-SPD	DB1
UNITS	DEG-F	DEG	MPH	DEG
FSCALE	122.0	360.0	100.0	99.9
ZERO	-32.0	0.0	0.0	00.0

=====+••••+

11:05	54.2	316.3	6.0	38.2
11:10	54.2	307.0	4.9	39.7
11:15	54.0	334.8	4.7	42.4
11:20	55.1	314.6	3.5	37.4
11:25	55.1	344.9	4.5	32.5
11:30	55.4	303.0	3.9	43.5
11:35	55.2	339.0	2.7	43.8
11:40	55.4	271.0	3.3	59.6
11:45	55.9	323.8	3.8	50.1

11:50	55.5	281.9	3.0	74.6
11:55	55.4	285.0	4.0	41.3
12:00	55.9	301.0	1.7	46.9

1-16-91

DATE:

Detectors Client: ESK / R&D mg. Inc.

PROJECT #: 2246 - 001 - 600

Blaster #: 101
Blaster operation: 40 / SWL
0.18 lbs each Burner

LOCATION: Calfax AF

AMBIENT TEMP (F): 42.2 TIME: 8:00

BAROMETRIC PRESSURE (in Hg) 76.3

RUN #: 6

PUMP NUMBER

SAMPLE LOCATION

END TIME

START TIME

AVG. STD. FLOW RATE

TOTAL VOL

AUXILIARY
ITEMSTATION
NUMBERTYPICAL
BALANCE

sample no	collection media	sample location	pump number	start time	end time	elapsed time	avg. std. flow rate	total vol	station number	typical balance
17A-6-SED	8x10 Filter	DNW SSW	7001051	10:38	11:39	61	42.50 scfm	2,898 SCF	① 10:3 Location	
17B-6-SED		" "	7001001				50.75 scfm	3,096 SCF	② 10:4 Location and 10:5 pump	
17C-6-SWD		DNW SW	15237-116				48.50 scfm	2,959 SCF		
17D-6-SWD		" "	15233-008				45.25 scfm	2,760 SCF	③ 10:5 Location	
17E-6-SED		UWW NW1	31821				46.75 scfm	2,852 SCF	11:00 AM	
17F-6-SED		UWW NW2	17161				47.50 scfm	2,898 SCF	④ 11:04 Location and 11:05 pump	
17G-6-SED	8x10 Filter	DNW	17163	Field	BLANK	61			⑤ 11:03 Location	
17H-6-SED		" "	31824	"	"				⑥ 11:22 Location	

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2

SAMPLE DATA SHEET

DATE: 1-16-74
 CLIENT: Edmunds Inc.
 PROJECT #: 3244 - 05
 OPERATOR: S. S. L.

RUN #: 6
 LOCATION: CelFec, LA
 AMBIENT TEMP (°F) 42 TIME: 9:00
 BAROMETRIC PRESS. (in Hg) 30.05

Sample #2

SAMPLE ID	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME (min.)	AVG. STD. FLOW RATE (ml/min.)	TOTAL VOL (liters)	ANALYTICAL RESULT	
									C	C ₀ PREVIOUS S. CEC (shaded 1-15-74)
POLY-BR	Timp	-	-	10:38	10:50	12	C	C		
VOC-TR	VOST	-	-	-	10:50	-	C	C		
POLY-BR	Timp	Upwind	10017	10:38	10:38	0				
VOC-TR	VOST	NW	10018	10:38	10:38	0				
POLY-BR	Timp	Upwind	10017	10:38	10:38	0				
VOC-TR	VOST	SW	10018	10:38	10:38	0				
POLY-BR	Timp	Downdwind	10024	10:38	10:38	0				
VOC-TR	VOST	SE	10025	10:38	10:38	0				
POLY-BR	Timp	Downdwind	10027	10:38	10:38	0				
VOC-TR	VOST	SE	10028	10:38	10:38	0				
POLY-BR	Timp	Downdwind	10029	10:38	10:38	0				
VOC-TR	VOST	SE	10030	10:38	10:38	0				
POLY-BR	Timp	-	-	10:38	10:38	0				
VOC-TR	VOST	upwind NW	-	10:38	10:38	0				
POLY-BR	Timp 2	TRIP	-	-	10:38	0				
VOC-TR	Timp 2	WEST	-	-	10:38	0				

ROSS-SECTIONING

1. Slopes 1½ to 1.

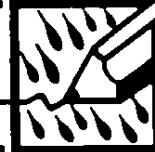
7. "Cut or Fill" and under .3 from the side stake at left. Also, "Fill" and under .1 read 16.7, the .8 at right.



Stake	.7	.8	.9	Cut or Fill
1.1	1.2	1.4	0	
2.6	2.7	2.9	1	
4.1	4.2	4.4	2	
5.6	5.7	5.9	3	
7.1	7.2	7.4	4	
8.6	8.7	8.9	5	
10.1	10.2	10.4	6	
11.6	11.7	11.9	7	
13.1	13.2	13.4	8	
14.6	14.7	14.9	9	
16.1	16.2	16.4	10	
17.6	17.7	17.9	11	
19.1	19.2	19.4	12	
	20.7	20.9	13	
	22.2	22.4	14	
23.6	23.7	23.9	15	
25.1	25.2	25.4	16	
26.6	26.7	26.9	17	
28.1	28.2	28.4	18	
29.6	29.7	29.9	19	
31.1	31.2	31.4	20	
32.6	32.7	32.9	21	
34.1	34.2	34.4	22	
35.6	35.7	35.9	23	
37.1	37.2	37.4	24	
38.6	38.7	38.9	25	
40.1	40.2	40.4	26	
41.6	41.7	41.9	27	
43.1	43.2	43.4	28	
44.6	44.7	44.9	29	
46.1	46.2	46.4	30	
47.6	47.7	47.9	31	
49.1	49.2	49.4	32	
50.6	50.7	50.9	33	
52.1	52.2	52.4	34	
53.6	53.7	53.9	35	
55.1	55.2	55.4	36	
56.6	56.7	56.9	37	
58.1	58.2	58.4	38	
59.6	59.7	59.9	39	
61.1	61.2	61.4	40	

FJ90 A0 124
Log book

"Rite in the Rain"
ALL-WEATHER WRITING PAPER ©



Name Steve W. Joauer
ENSR

Address 33 Nagog Park
Acton, MA 01720

Phone (508) 635-9500

Project Red Hill Inc.

FEAG-CC1-GCO

"Rite In the Rain"—a unique all-weather writing surface created to shed water and to enhance the written image. Makes it possible to write sharp, legible field data in any kind of weather.

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16

R&D Mfg. Inc.

1

DATE

1-2-91
1-10-91

1-2-91 Arrived in Alexandria, LA.
x 4:30pm Checked into
hotel. Mark Greenberg called
Richard Crane to let him
know we'll be out to site
@ 8:30 on 1-3.

1-3-91 Site Tour

Unpackaged Samples
Power connected to
bulldozer at lower site
and -Tandler prep
started.

Sample heads cleaned w/
Acetone

All equipment inspected
and sites tested.

1-4-91 Began filling samples
around lower site

All glass-ware cleaned
w/ Acetone

Refrigerators plugged in.
Office trailer due to
negative Sat.

(2)

1-4-91 Met system installed
and aligned. Cross
site east-west. Mag.
inclination = 5° W. Site N.E.
system $15^{\circ} + 275^{\circ}$ (W)
Scintos arrived - in relicker
Begin sharing pumps and
intake calibrations

1-5-91 Coop site set up
Power connected ^{most} sampling
site. Cables and pipe hooked

Trailer wired - power
connected. Power was
connected to trailer;
refrigerator & refrigerator
water supply.

Install water meter site
at completed wind site
ID (RED Mfg.)

Using static barometric

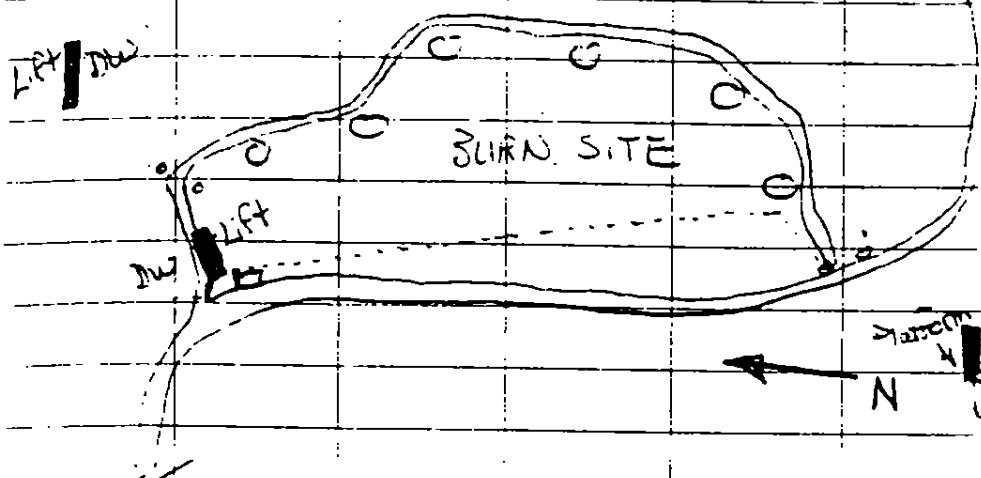
Wind speed / 24 hr timer

Weather forecast out good

North to NE winds and
rain coming

Site Locations to date (3)

1-5-91



To one exposure / 2 Densities
for South winds

Will pick up 2 rental Vid
Cameras on Monday
3rd Camera on charger at
site will have 3 tripods

1-6-91 Winds & weather bad for
Sunday No Sampling -
Sun Did not go to site -
Scheduled Sampling on
Monday but forecast
not good

(4)

1-7-91

MON.

Odessa logger ran out of paper. Replaced and print missing data from 1-7. We reconfigured logger because it print header with each 15 min average. Now it will auto list 5 min average each hour with 15 minute average every 6 hours for previous 6 hrs.

Power to all sites and samples. Calibrations (initial) complete. Laboratory set up. Visit alpha pump cols @ x/100

All cameras on-site with tripods & chargers - Camera will have to run off AC. Charging all batteries. Line to site - winds Richter to NE. No sampling possible.

TNT ordered - will arrive in a day or two.

1-8-91

It's hurry to set up
the site to winds in North
Forecast for wed says
windy and North with
rain due on Thursday

Organize paperwork &
make adjust menus to
electrical hook ups.

Check out and set our
locations - attempting to
see all burn pots while
seeing plumes in sky.

Richard Crane showed us
a test burn of RDX
while we filmed from
Ludwigsburg / down wind
camera. We later ate
the films, and the next
day again with good
film quality.

C.SX Division plan to
arrive wed.

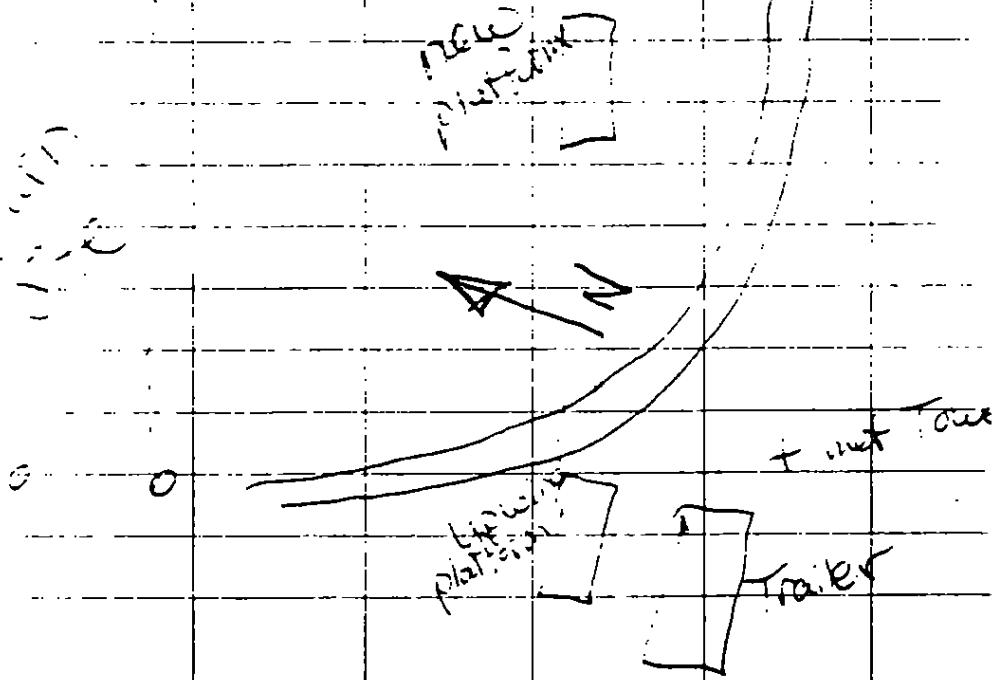
(6)

1-9-91

WED

Jim Gallagher going to airport for hotel - not on site.

Met with Mark & GSK environmental head to discuss test. Decision was made to get 3 more Hi-Vols for a fourth site in order to be able to sample with North or South wind. Location chosen - Platfo installed. Many trees cut to open site to burn are



7

1-9-91 3 samplers order via
Nelson VanDerStoer Fire Co.
They will arrive Thursday
Priority 1 Fed Ex We
had 2 FS-1's on site &
4th TNT Sampler & Co-loc

* Great lunch from Cabil at trailer

Built Phenol impinger train
and capped with teflon tops

Louie is mapping site (run
and sample locations)

We have arrived to area
soil samples this night
on site today to sample.

Forecast is of very little
rain on Thursday and
maybe Friday.

We'll see if FED EX can
hold samplers so we can
get them to site earlier for
4 pm on Thurs.

(8)

1-10-91 Heavy rain over night
Continuing today.

TUE. Went to FedEx at 9:
Samples already on truck
for PM delivery. Called
Richard but no answer
so we went to site.

Checked met data and
left note for Richard th
we would see him Fri
- very heavy rain - lac
land flooding

1-11-91 Cloudy, brief - Northw
FRI. winds. Moved samp
to new location and
broke up power and a
cable.

Found cabin lower than
Hi-Way not adjusted yet to
50 cm, decided on 4
and adjusted all but
the ones on the blue if
stopped due to darkness.

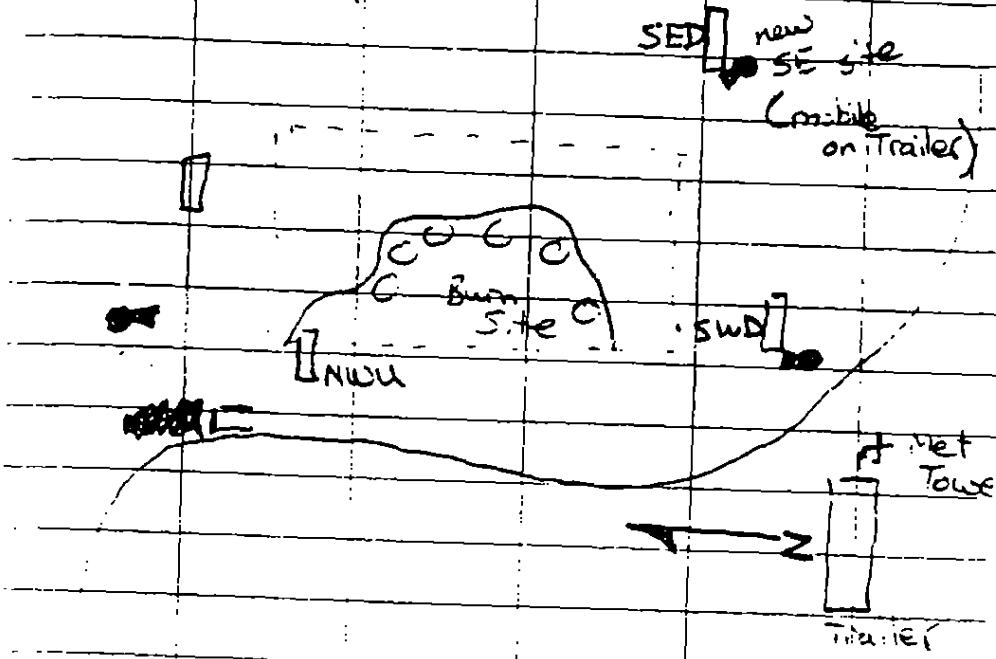
NW winds made sample
impossible even with new loca

(6)

7-12-91

Winds still NWW

Sat's making sampling impossible
 with current configuration
 Decided to move platform
 in SW corner of burn s.
 over to SE corner —
 leaving S (new) platform
 in place



The Configuration for
 Run # 1

SED = Southeast Downwind

SWD = Southwest Downwind

NWU = Northwest Upwind

= Camera Location

10

1-12-91 Many trees had to be cleared before testing as new wires run.

Run #1 began at 1514 we stopped from 1519 to 152 where sampling resumed. Test finished at 1619 (60 min)

110 pounds of RDX was burned in 11 burns of 10 lbs each. We decided to double the burns as the first one went into the woods with no imp. By completion of the test we observed six burns reached downwind sample. This met the objective

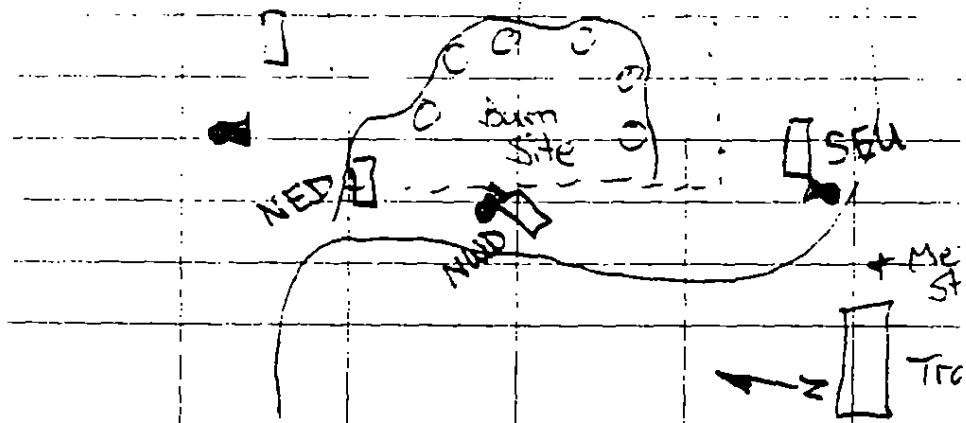
Wires went NW to SW through burn.

(11)

1-13-91

On Sunday wind's
SUN shifted to the SE
finally, but our SAM
configuration was set
up for South to South
winds as instructed.

Richard Crane told us that
SW winds rarely occur.
Thus we had yet another
change in location of SA
station. This time the
SE station was left on
a trailer for easy movement
with a few more trees c
down the following new
configuration was used
for runs 2, 3, 4, & 5.



(12)

1-13-91

SEU = Southeast Upwind

NWD = Northwest downwind

NED = Northeast downwind

● = Camera locations

Run # 2 began at
1118 and ended at 1218
with winds from the
SE to SSE

Major impact was on site
NWD (see pg 11)

120 lbs of RDX was buried
in 12 burns of 10 lbs ea

Again six of the burns
appeared to impact the saw.
The upwind Phenol Train
was started late due to
problem with Tenar tube
being pack too tight with
glass wool. The train is
started late due to time
needed for VOST repair
and inadvertent shutdown
of pump on Phenol
All other sample ran 60 mi

1-14-91 Runs 3, 4, & 5 were MCN. completed on this day Run 3 & 4 were pure TNT. Each run had 60 lbs at 10 lbs per bin for a total of 120 lbs.
(see pg 11 ↓)

The NWID site caught most of the fallout with NEI seeing some also. Winds were from the SE to SSE.

Run # 3 started 0912 and ended at 1012

A circuit breaker tripped on the NED platform turning off the Hi-Vals after 5 minutes. However, the total impact from TNT was on the NWID platfor

Run # 4 began at 1242 and ended at 13: Impact from the TNT bi

(14)

1-14-91 was on the NED platt
which ran the full 100m.
A breaker tripped on NL
platform after 22 min.
Again this happed to the
secondary downwind sit
so the burn was a stucck

Run # 5 was Lead
Azide detonators conti.
• 18 lbs of lead azide
10 lbs of plastic focus
20 lbs of Aluminum & Stain
steel

Six burns of .18 lbs of
lead azide per burn.

Run 5 started at 15
and ended at 16:45
The NED & Ned sites
were impacted
(see pg 11)

All samplers ran well

(15)

1-15-91

TUE Winds are light and
variable from SW to WNW
we need NW winds to
test.

Shipped samples to
Labs via Fed Ex P1
(Runs 1-5)

Phenol to Camarillo

HOST/TNT to Acton

RDX to St Louis

PAH & Part/Metals to Acton will
be sent tonight or tomorrow

At 4:00 decided we
had to wait to wed for
possible NW winds

(1c)

1-16-91

WED Run #6 began
at 1038 and ended
at 1138. Winds were
from the Northwest
impacting site SED and
SED. Southeast down
wind got the most of
fallout. See pg 9
of log for obforan
configuration.
Balance of samples
& Video Tape shipped
via Fed Ex P1
today.

Wind we hear off
line, E testing is
complete.

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General Notes

Meteorological Data

- incorrect year (listed as 1980 - should be 1991)

Trial Burns

4. RDX burns

1. Wind direction varying between NW and W
2. initial burn (#1 & 6) didn't impact samplers - decision was made to effectively double number of burns to increase chance of impacting samplers. 11 burns completed on RDX Burn #1 (110 lbs total)
3. Approx. 50% of burns impacted samplers (little plume visible, odor was used for verification of impact.)
4. RDX Burn #2 consisted of 12 burns (120 lbs total) for the same reason of varying winds & consistency. Winds were SSE to almost S

3. TNT Burns

1. Constant winds of SE direction
2. Burn #1 impacted NW platform, while NE platform had technical problems
3. Burn #2 impacted NE platform, while NW platform had technical problems

2. Detonator-Burns

1. Burn #1 had ~~SE~~ winds impacting both NW and NE platforms based on odor & smoke ~~with the fire more~~
2. Burn #2 saw NW to NW winds. Both SW and SE platforms were impacted based on plumes and odor

General Notes

Pg 2

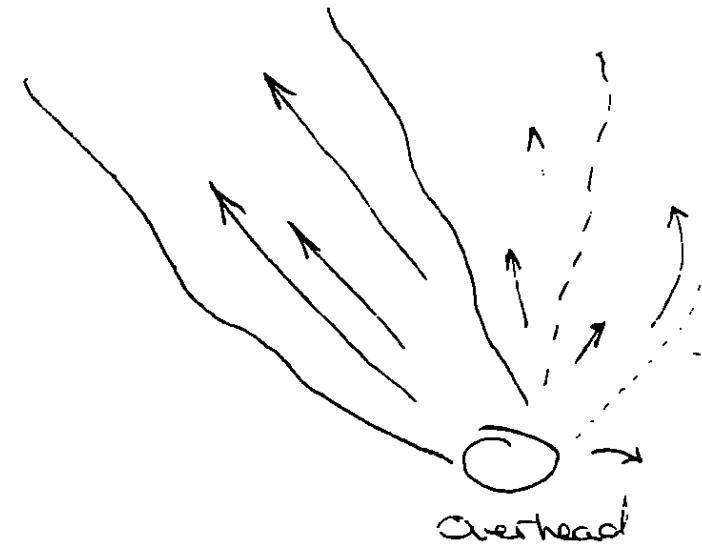
General

1. Fluctuations of winds on a micro scale (on burn site) cause plumes to fan back and forth. Estimating percent of impact on samplers on an individual or per burn basis will be difficult.

Examples



Front View



Overhead

2. Prevailing direction is apparent, but minor variations carry plume in undesired direction for short periods.
3. Especially on TNT burns, impact on filter visibly evident. Detonators also visible. RDX only estimated by odor and slight plumes.

EXPLOSIVE TYPE & POUNDAGE BURNED

TYPE	Burn #	lb/burn pot	lb./Total burn	Burn Mater
1.	RDX #1	11	10	110.
	RDX #2	12	10	120.
2.	TNT #1	6	10	60.
	TNT #2	6	10	60.
3.	DET #1	6	.18	1.08
	DET #2	10	.18	1.20

ENSR

FIELD STATION LOG

SITE MET STATION
NETWORK R&D Mfg., Inc.
PROJECT NUMBER PP 16 - CCI - CC

DATE	TIME	COMMENTS	INITIALS	EMP. NO.
1-4-91 FRI	1400	Net System Installed and operational Sighted using Mag. Declin. 5° (365° or 5° = True North.)	SCW	4241
1-5-91 SAT	1145	Initial Trial Printer Configuration List (Auto) from several 5 min drgs on the new	SCW	4241
		Change Final output to cartridge in 1 hour drgs to 15 min drgs		
5-7-91 1357/ 1355		Calibration Verification of LID/LIS	SCW	4241
1-6-91 SUN	-	NO Personnel on site		

ENSR**FIELD STATION LOG**SITE MET STATION
NETWORK R&D Mfg., Inc
PROJECT NUMBER 3246-001-600

DATE	TIME	COMMENTS	INITIALS	EMP. NO.
1-7-90 MON	1000	Re-Configure Printer Auto Output 5 min. hourly Avg. 15 min 24 hour Avg	SCW	4241
1-8-90 TUE		WINDS FM NORTH no sampling	SCW	
1-9-90 WED		WINDS FM NORT no sampling order more samplers	SCW	
1-10-90 THUR		WINDS E HEAVY RAIN 2.5 - 3.5 "	SCW	
1-11-90 FRI		WINDS FM NW New Site located for NE winds NO Sampling Drizzle	SCW	

FIELD STATION LOG

SITE MET STATION
NETWORK RED MFg, Inc
PROJECT NUMBER 3146-001-1000

DATE	TIME	COMMENTS	INITIALS	EMP. NO.
81-12-91	AM	WINDS NW to WNW Relocate site in trailer for Sampling	SCW	4241
1-12-91	1514	Begin Run # 1 at 1514 CST Delay from 1514 to 1524 Complete Run # 1 at 1619 CST	SCW	

ENSR**FIELD STATION LOG**SITE Met Station
NETWORK R&D Mfg, Inc
PROJECT NUMBER 3246-001-000

DATE	TIME	COMMENTS	INITIALS	EMP NO.
1-13-91	0840	Remove Cartridge # 1 From Cdrssq (Data Run 1-4 thru 1-13-91) Install Cartridge # 2 at 0840 1-13-91 Cartridge # 1 Contains Run # 1 Data	SCW	4241
1-17-91	0919	Cartridge Removed Contains Runs 2 through 6	SCW	4241

EXTRACTABLE EXPLOSIVES

PROJECT NUMBER 3904120V L204
FIELD GROUP ETE-S1PROJECT NAME ETE, INC.
LAB COORDINATOR J.D. SHAMIS

DATE OF COLLECTION: 1/09/91

RESULTS OF ANALYSIS

NET CODE:	98577	98575	98573	99817	98774	99889	99621	99795	98165	98576	98574
TOO CODE:	LW12										
ITER:	130MB	24DNT	26DNT	HMX	NB	NO	PETN	RDX	TETRYL	135TNB	246TNT
TS:	UG/G-DRY										
SAMPLE ID	TIME										
R+D-B1N	14:00	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	8.674	<0.731	<0.488
R+D-B1S	14:05	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	2.16	<0.731	<0.488
R+D-B1E	14:05	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	8.996	<0.731	<0.456
R+D-B1W	14:00	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B2S	14:45	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B2S	14:50	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B2E	14:55	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B2W	14:45	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B3N	15:05	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B3S	15:05	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	1.18	<0.731	<0.456
R+D-B3E	15:10	<0.496	<0.424	<0.524	0.726	<2.41	<4.00	<4.00	2.61	<0.731	<0.488
R+D-B3N	15:10	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B3W	15:10	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B4N	15:30	<0.496	<0.424	<0.524	0.758	<2.41	<4.00	<4.00	2.93	<0.731	<0.456
R+D-B4S	15:30	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B4S	15:30	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B4W	16:00	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B5N	16:00	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B5S	16:00	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B5E	16:00	<0.496	<0.424	<0.524	2.75	<2.41	<4.00	<4.00	3.44	<0.731	<0.488
R+D-B5W	16:00	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B6N	16:25	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B6S	16:25	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B6E	16:25	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B6W	16:25	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B7N	16:50	<0.496	<0.424	<0.524	3.45	<2.41	<4.00	<4.00	2.19	<0.731	<0.488
R+D-B7S	16:50	<0.496	<0.424	<0.524	1.18	<2.41	<4.00	<4.00	1.06	<0.731	<0.456
R+D-B7E	16:50	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	1.65	<0.731	<0.488
R+D-B7W	16:50	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	0.989	<0.731	<0.456
R+D-B8N	17:05	<0.496	<0.424	<0.524	1.68	<2.41	<4.00	<4.00	13.3	<0.731	<0.488
R+D-B8S	17:05	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	1.74	<0.731	<0.456
R+D-B8E	17:05	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	2.45	<0.731	<0.488
R+D-B8W	17:05	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B9N	17:30	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B9S	17:30	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B9E	17:30	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B9W	17:30	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-B10N	17:55	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B10S	17:55	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	3.92	<0.731	<0.456
R+D-B10E	17:55	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-B10W	17:55	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.488
R+D-BKGDA	18:45	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456
R+D-BKGDB	18:45	<0.496	<0.424	<0.524	<0.666	<2.41	<4.00	<4.00	<0.587	<0.731	<0.456

APPENDIX VIII
TOTAL METALS

1
Received: 01/14/91

02/08/91 11:11:09

Work Order # 91-01-065

REPORT ENVIRONMENTAL TEC. ENG., INC. PREPARED Davis & Floyd, Inc.
TO POST OFFICE BOX 1867 BY P.O. Drawer 428
1445 PISGAH CHURCH RD. Greenwood, S.C. 29648
LEXINGTON, S.C. 29072
ATTEN MICHAEL YOUNG

WORK ID JOB # 7488.00

P.O. #

TAKEN ETE

TYPE SOIL

NUMBER OF SAMPLES 24

Comments:

WE ARE PLEASED TO PROVIDE THIS CERTIFIED REPORT OF ANALYSES.
FEEL FREE TO TELEPHONE IF FURTHER EXPLANATION IS REQUIRED.
UNLESS OTHER ARRANGEMENTS HAVE BEEN MADE, SAMPLES WILL BE
DISPOSED OF OR RETURNED 28 DAYS FROM THE DATE OF THIS REPORT.

John H. McCord
CERTIFIED BY
JOHN MCCORD

SAMPLE IDENTIFICATION	DATE COLLECTED	SAMPLE IDENTIFICATION	DATE COLLECTED
01 B1N	01/09/91 14:00:00	22 B6S	01/09/91 16:25:00
02 B1S	01/09/91 14:05:00	23 B6E	01/09/91 16:25:00
03 B1E	01/09/91 14:05:00	24 B6W	01/09/91 16:25:00
04 B1W	01/09/91 14:00:00		
05 B2N	01/09/91 14:45:00		
06 B2S	01/09/91 14:50:00		
07 B2E	01/09/91 14:55:00		
08 B2W	01/09/91 14:45:00		
09 B3N	01/09/91 15:05:00		
10 B3S	01/09/91 15:05:00		
11 B3E	01/09/91 15:10:00		
12 B3W	01/09/91 15:10:00		
13 B4N	01/09/91 15:30:00		
14 B4S	01/09/91 15:30:00		
15 B4E	01/09/91 15:30:00		
16 B4W	01/09/91 15:30:00		
17 B5N	01/09/91 16:00:00		
18 B5S	01/09/91 16:00:00		
19 B5E	01/09/91 16:00:00		
20 B5W	01/09/91 16:00:00		
21 B6N	01/09/91 16:25:00		

Re 1
Received: 01/14/91

Work Order # 91-01-066

02/08/91 11:20:21

REPORT ENVIRONMENTAL TEC. ENG., INC.

TO POST OFFICE BOX 1867

1445 PISGAH CHURCH RD.

LEXINGTON, S.C. 29072

ATTN MICHAEL YOUNG

WORK ID JOB # 7488.00

P.O. #

TAKEN ETC

TYPE SOIL

NUMBER OF SAMPLES 18

PREPARED Davis & Floyd, Inc.

BY P.O. Drawer 428

Greenwood, S.C. 29648

JOHN MCCORD

PHONE (803)-229-5211

CERTIFIED BY

John H. McCord

Comments:

WE ARE PLEASED TO PROVIDE THIS CERTIFIED REPORT OF ANALYSES.

FEEL FREE TO TELEPHONE IF FURTHER EXPLANATION IS REQUIRED.

UNLESS OTHER ARRANGEMENTS HAVE BEEN MADE, SAMPLES WILL BE

DISPOSED OF OR RETURNED 28 DAYS FROM THE DATE OF THIS REPORT.

SAMPLE IDENTIFICATION

01 B7N	DATE COLLECTED
02 B7S	01/09/91 16:50:00
03 B7E	01/09/91 16:50:00
04 B7W	01/09/91 16:50:00
05 B8N	01/09/91 17:05:00
06 B8S	01/09/91 17:05:00
07 B8E	01/09/91 17:05:00
08 B8W	01/09/91 17:05:00
09 B9N	01/09/91 17:30:00
10 B9S	01/09/91 17:30:00
11 B9E	01/09/91 17:30:00
12 B9W	01/09/91 17:30:00
13 B10N	01/09/91 17:55:00
14 B10S	01/09/91 17:55:00
15 B10E	01/09/91 17:55:00
16 B10W	01/09/91 17:55:00
17 BKGD "A"	01/09/91 18:45:00
18 BKGD "B"	01/09/91 18:45:00

P 3
Received: 01/14/91

Results by Sample

Work Order # 91-01-065

SAMPLE ID B1S

FRACTION 02A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:05:00 Category

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	1	mg/kg		
Arsenic				
Barium				
Beryllium				
Cadmium				
Chromium				
Cobalt				
Copper				
Lead				

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Antimony	BDL	3.2	Mercury	0.09	0.08
Arsenic	0.45	0.32	Nickel	2.5	1.3
Barium	62.0	1.3	Selenium	BDL	0.32
Beryllium	0.32	0.32	Silver	BDL	1.3
Cadmium	0.25	0.13	Thallium	<0.38	0.32
Chromium	5.4	0.6	Tin	BDL	3.2
Cobalt	1.5	1.3	Vanadium	5.5	1.3
Copper	1351	1.3	Zinc	53.7	1.3
Lead	57.7	3.2			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.

4
Received: 01/14/91

Work Order # 91-01-065

Results by Sample

SAMPLE ID B1E

FRACTION 03A TEST CODE AP9TH NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:05:00 Category

ANALYST DL IH JE

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	DET LIMIT	3.0			
Arsenic	BDL				
Barium	0.72	0.30			
Beryllium	49.9	1.2			
Cadmium	BDL	0.3			
Chromium	0.17	0.12			
Cobalt	BDL	0.6			
Copper	BDL	1.2			
Lead	17406	1.2			
	114	3.0			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 2
Received: 01/14/91

SAMPLE ID BIN

FRACTION 01A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:00:00 Category

Work Order # 91-01-065

Results by Sample

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.1	Mercury	0.42
Arsenic	0.81	0.31	Nickel	1.3
Barium	45.1	1.3	Selenium	BDL
Beryllium	BDL	0.31	Silver	BDL
Cadmium	BDL	0.13	Thallium	<0.63 X
Chromium	4.1	0.6	Tin	BDL
Cobalt	1.8	1.3	Vanadium	3.9
Copper	4.91	1.3	Zinc	25.5
Lead	34.7	3.1		1.3

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 5
Received: 01/14/91

Work Order # 91-01-065

Results by Sample

SAMPLE ID BLW

FRACTION 04A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:00:00 Category

ANALYST DL_IH_JE

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	2.8	mg/kg		
Arsenic	0.34	0.28			
Barium	26.4	1.1			
Beryllium	BDL	0.28			
Cadmium	BDL	0.11			
Chromium	3.5	0.6			
Cobalt	BDL	1.1			
Copper	12.1	1.1			
Lead	6.3	2.8			

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Mercury	BDL	0.07	Nickel	BDL	1.1
Selenium	BDL	0.28	Silver	BDL	1.1
Thallium	<0.45	X	Tin	BDL	0.28
Zinc	BDL	2.8	Vanadium	3.8	1.1
				5.9	1.1

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

7
Received: 01/14/91

SAMPLE ID B2N

FRACTION 05A TEST CODE AP9TH NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:45:00 Category

Work Order # 91-01-065

Results by Sample

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.2	Mercury	DET LIMIT
Arsenic	0.78	0.32	Nickel	0.08
Barium	52.0	1.3	Selenium	1.3
Beryllium	BDL	0.32	Silver	2.2
Cadmium	BDL	0.13	Thallium	<0.6 X
Chromium	4.1	0.6	Tin	0.32
Cobalt	1.6	1.3	Vanadium	10.7
Copper	994	1.3	Zinc	3.2
Lead	43.8	3.2		2.9
				21.6

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

8
Received: 01/14/91

SAMPLE ID B2S

Work Order # 91-01-065

Results by Sample

FRACTION 06A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:50:00 Category

ANALYST DL_IH_JE

COMPOUND	RESULT	DET LIMIT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.2		mg/kg		
Arsenic	BDL	0.32				
Barium		1.3	29.3			
Beryllium	BDL	0.32				
Cadmium	BDL	0.13				
Chromium		0.6	3.1			
Cobalt	BDL	1.3				
Copper	109	1.3				
Lead	10.0	3.2				

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

9
Received: 01/14/91

SAMPLE ID B2R

Work Order # 91-01-065

Results by Sample

FRACTION 07A TEST CODE APP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:55:00 Category

ANALYST DL_IH_JB

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED
Antimony	<6.6 X	3.1	mg/kg	JHM
Arsenic	0.62	0.31		
Barium	35.0	1.2		
Beryllium	BDL	0.31		
Cadmium	0.22	0.12		
Chromium	8.7	0.6		
Cobalt	BDL	1.2		
Copper	40010	1.2		
Lead	1.88	3.1		

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Mercury			Nickel		
Selenium			Silver		
Thallium			Tin		
Vanadium			Zinc		

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P11
Received: 01/14/91

Work Order # 91-01-065

Results by Sample

SAMPLE ID B2W

FRACTION 08A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 14:45:00 Category

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	BDL	3.0			
Arsenic	0.43	0.31			
Barium	23.1	1.2			
Beryllium	BDL	0.30			
Cadmium	BDL	0.12			
Chromium	5.5	0.6			
Cobalt	1.3	1.2			
Copper	35.4	1.2			
Lead	6.2	3.0			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

F-12

Received: 01/14/91

SAMPLE ID B3N

Fraction 09A TEST CODE APP9TM NAME APPENDIX IX TRACE METALS
 Date & Time Collected 01/09/91 15:05:00 Category

Work Order # 91-01-065

Results by Sample

ANALYST DL_JH_JE

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Antimony	BDL	2.9	Mercury	BDL	0.08
Arsenic	0.64	0.29	Nickel	1.5	1.2
Barium	31.4	1.2	Selenium	BDL	0.29
Beryllium	0.32	0.29	Silver	BDL	1.2
Cadmium	BDL	0.12	Thallium	<0.46 X	0.29
Chromium	7.1	0.6	Tin	BDL	2.9
Cobalt	1.4	1.2	Vanadium	8.3	1.2
Copper	10.0	1.2	Zinc	12.0	1.2
Lead	10.0	2.9			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P-114
Received: 01/14/91

Work Order # 91-01-065

Results by Sample

SAMPLE ID B3S

FRACTION 10A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 15:05:00 Category

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	ma/kg	VERIFIED	JHM
Antimony	BDL	9			
Arsenic	1.2	0.94			
Barium	154	4			
Beryllium	0.2	0.2			
Cadmium	BDL	0.4			
Chromium	23.6	2			
Cobalt	6	4			
Copper	1032	4			
Lead	115	9			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P-15
Received: 01/14/91

SAMPLE ID B3E

Results by Sample

Work Order # 91-01-065

FRACTION 11A TEST CODE AP97K NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 15:10:00 Category

ANALYST DL_JH_JE

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	1				
Arsenic	1				
Barium	1.5	DET LIMIT	0.82	Mercury	
Beryllium	154	DET LIMIT	3	Nickel	
Cadmium	1.3	DET LIMIT	0.8	Selenium	
Chromium	1.7	DET LIMIT	0.3	Silver	
Cobalt	22	DET LIMIT	2	Thallium	
Copper	5	DET LIMIT	3	Tin	
Lead	7123	DET LIMIT	3	Vanadium	
	230	DET LIMIT	6	Zinc	

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 16
Received: 01/14/91

Results by Sample

SAMPLE ID B3W

FRACTION 12A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 15:10:00 Category

Work Order # 91-01-065

ANALYST DL IH JE

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.1		
Arsenic	0.38	0.31		
Barium	58.5	1.3		
Beryllium	BDL	0.31		
Cadmium	BDL	0.13		
Chromium	12.3	0.6		
Cobalt	1.9	1.3		
Copper	19.6	1.3		
Lead	23.5	3.1		

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Antimony	BDL	0.08	Mercury	BDL	0.08
Arsenic	0.38	0.31	Nickel	BDL	1.3
Barium	58.5	1.3	Selenium	BDL	0.31
Beryllium	BDL	0.31	Silver	BDL	1.3
Cadmium	BDL	0.13	Thallium	<0.38 X	0.31
Chromium	12.3	0.6	Tin	BDL	3.1
Cobalt	1.9	1.3	Vanadium	5.4	1.3
Copper	19.6	1.3	Zinc	38.4	1.3
Lead	23.5	3.1			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

PB 17
Received: 01/14/91

Results by Sample

Work Order # 91-01-065

SAMPLE ID B4N

FRACTION 13A TEST CODE APP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 15:30:00 Category

ANALYST DL_IH_JE

COMPOUND	RESULT	DET LIMIT	UNITS	mg/kg	VERIFIED	JHM
Antimony	BDL	3.0	COMPOUND			
Arsenic	0.61	0.30	Mercury			
Barium	48.2	1.2	Nickel			
Beryllium	BDL	0.30	Selenium			
Cadmium	0.19	0.12	Silver			
Chromium	4.0	0.6	Thallium			
Cobalt	1.6	1.2	Tin			
Copper	2263	1.2	Vanadium			
Lead	91.8	3.0	Zinc			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P-18
Received: 01/14/91

Results by Sample

SAMPLE ID B4S

FRACTION 14A TEST CODE AP9TM NAME APPENDIX IX TRACK METALS
Date & Time Collected 01/09/91 15:30:00 Category

Work Order # 91-01-065

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	3.1	COMPOUND			
Arsenic	0.32	Mercury			
Barium	1.3	Nickel			
Beryllium	56.6	Selenium			
Cadmium	0.31	Silver			
Chromium	0.13	Thallium			
Cobalt	12.1	Tin			
Copper	0.6	Vanadium			
Lead	2.5	Zinc			
	354				
	74.0				
	3.1				

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 19
Received: 01/14/91

Work Order # 91-01-065

Results by Sample

SAMPLE ID B48

FRACTION 15A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 15:30:00 Category

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	mg/kg
Antimony	BDL	1	
Arsenic	0.77	3.2	
Barium	52.4	0.32	
Beryllium	0.40	1.3	
Cadmium	BDL	0.32	
Chromium	BDL	0.13	
Cobalt	BDL	0.6	
Copper	2.4	1.3	
Lead	10271	1.3	
	162	3.2	

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Mercury	BDL	1			
Nickel	0.77	3.2			
Selenium	52.4	0.32			
Silver	0.40	1.3			
Thallium	BDL	0.13			
Tin	BDL	0.6			
Vanadium	2.4	1.3			
Zinc	10271	1.3			
	162	3.2			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 20
Received: 01/14/91

Work Order # 91-01-065

Results by Sample

SAMPLE ID B4W

FRACTION 16A TEST CODE AP9TH NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 15:30:00 Category

ANALYST DL_JH_JR

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Antimony	BDL	2.7	Mercury	BDL	0.07
Arsenic	0.48	0.27	Nickel	1.4	1.1
Barium	31.7	1.1	Selenium	BDL	0.27
Beryllium	BDL	0.27	Silver	BDL	1.1
Cadmium	BDL	0.11	Thallium	<0.32	0.27
Chromium	3.0	0.5	Tin	BDL	2.7
Cobalt	BDL	1.1	Vanadium	3.4	1.1
Copper	14.3	1.1	Zinc	6.5	1.1
Lead	10.4	2.7			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P422
Received: 01/14/91

Work Order # 91-01-065

SAMPLE ID BSN

FRACTION 17A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:00:00 Category

Results by Sample

ANALYST DL_JH_JE

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	BDL	2.9		Mercury	DET LIMIT
Arsenic	0.76	0.29		Nickel	0.07
Barium	27.2	1.2		Selenium	1.2
Beryllium	0.30	0.29		Silver	0.29
Cadmium	BDL	0.12		Thallium	BDL
Chromium	5.7	0.6		Tin	<0.58 X
Cobalt	BDL	1.2		Vanadium	0.29
Copper	12.0	1.2		Zinc	BDL
Lead	13.5	2.9			5.2

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P-23
Received: 01/14/91

SAMPLE ID B5S

Work Order # 91-01-065

Results by Sample

FRACTION 18A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:00:00 Category

ANALYST DL_JH_JE

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	BDL	3.2			
Arsenic	0.64	0.32			
Barium	56.1	1.3			
Beryllium	0.38	0.32			
Cadmium	BDL	0.13			
Chromium	7.1	0.6			
Cobalt	1.7	1.3			
Copper	319	1.3			
Lead	11.6	3.2			

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Antimony	BDL	0.09			
Arsenic	0.64	1.3	Nickel	1.9	1.3
Barium	56.1	0.32	Selenium	<0.61	0.32
Beryllium	0.38	0.32	Silver	BDL	1.3
Cadmium	BDL	0.13	Thallium	<0.511	0.32
Chromium	7.1	0.6	Tin	BDL	3.2
Cobalt	1.7	1.3	Vanadium	8.2	1.3
Copper	319	1.3	Zinc	15.9	1.3
Lead	11.6	3.2			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.

P 24
Received: 01/14/91

SAMPLE ID B5E

Results by Sample

Work Order # 91-01-065

FRACTION 19A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:00:00 category

ANALYST DL_JH_JK

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	1	mg/kg		
Arsenic				
Barium				
Beryllium				
Cadmium				
Chromium				
Cobalt				
Copper				
Lead				

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
	BDL	3.3	Mercury	0.16	0.09
	1.11	0.33	Nickel	49.1	1.3
	1003	1.3	Selenium	<1.3	0.33
	0.36	0.33	Silver	BDL	1.1
	1.10	0.13	Thallium	<0.66	0.33
	219	0.7	Tin	4.8	3.3
	3.6	1.3	Vanadium	BDL	1.1
	19249	1.3	Zinc	428	1.3
	1633	3.3			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P-26
Received: 01/14/91

SAMPLE ID B5W

Work Order # 91-01-065

Results by Sample

FRACTION 20A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:00:00 Category

ANALYST DL_IH_JE

COMPOUND	RESULT	DET LIMIT	UNITS mg/kg	VERIFIED	JHM
Antimony	BDL	3.1			
Arsenic	0.49	0.31			
Barium	60.0	1.2			
Beryllium	0.49	0.31			
Cadmium	0.15	0.12			
Chromium	11.6	0.6			
Cobalt	2.1	1.2			
Copper	374	1.2			
Lead	21.4	3.1			

ANALYST DL_IH_JE

COMPOUND	RESULT	DET LIMIT	UNITS mg/kg	VERIFIED	JHM
Mercury	BDL	0.08			
Nickel	3.1	1.2			
Selenium	<1.5 X	0.31			
Silver	BDL	1.2			
Thallium	<0.49 X	0.31			
Tin	BDL	3.1			
Vanadium	9.2	1.2			
Zinc	50.2	1.2			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 27
Received: 01/14/91

SAMPLE ID B6N

Work Order # 91-01-065

Results by Sample

FRACTION 21A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:25:00 Category

ANALYST DL_IH_JR

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	1.9	8	Mercury	RESULT	DET LIMIT
Arsenic	1.13	0.8	Nickel	BDL	0.08
Barium	1.2	3	Selenium	4	3
Beryllium	BDL	0.8	Silver	BDL	0.8
Cadmium	19.6	0.3	Thallium	BDL	3
Chromium	5	1.7	Tin	BDL	0.8
Cobalt	14	3	Zinc	8	8
Copper	26	8		24	3
Lead				36	3

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Pg 28
Received: 01/14/91

SAMPLE ID B6S

Work Order # 91-01-065

Results by Sample

FRACTION 22A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:25:00 Category

COMPOUND	ANALYST DL JH JE
Antimony	
Arsenic	
Barium	
Beryllium	
Cadmium	
Chromium	
Cobalt	
Copper	
Lead	

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Mercury				
Nickel				
Selenium				
Silver				
Thallium				
Tin				
Vanadium				
Zinc				

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P-29
Received: 01/14/91

Results by Sample

Work Order # 91-01-065

SAMPLE ID B6E

FRACTION 23A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:25:00 Category

ANALYST DL_IH_JK

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	<12.4	2	Mercury	RESULT	DET LIMIT
Arsenic	2.7	0.9	Nickel	BDL	0.09
Barium	98	4	Selenium	30	4
Beryllium	BDL	0.9	Silver	<1.9	0.9
Cadmium	0.7	0.4	Thallium	BDL	4
Chromium	11	2	Tin	BDL	0.9
Cobalt	BDL	4	Tin	4.3	2
Copper	78874	4	Vanadium	6	4
Lead	192	9	Zinc	96	4

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 30
Received: 01/14/91

SAMPLE ID B6W

Results by Sample

Work Order # 91-01-065

FRACTION 24A TEST CODE APP9TH NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:25:00 Category

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.0	Mercury	0.19
Arsenic	1.37	0.30	Nickel	1.6
Barium	79.3	1.2	Selenium	<0.6
Beryllium	0.44	0.30	Silver	BDL
Cadmium	BDL	0.12	Thallium	BDL
Chromium	6.3	0.6	Tin	BDL
Cobalt	3.1	1.2	Vanadium	8.5
Copper	760	1.2	Zinc	15.1
Lead	13.1	3.0		

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 2
Received: 01/14/91

Work Order # 91-01-066

Results by Sample

SAMPLE ID B7N

FRACTION 01A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:50:00 Category

ANALYST DL_IH_JE

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.0	mg/kg		
Arsenic	1.01	0.30		BDL	0.08
Barium	104	1.2		BDL	1.2
Beryllium	0.42	0.30		BDL	0.30
Cadmium	BDL	0.12		BDL	1.2
Chromium	22.6	0.6		BDL	0.30
Cobalt	1.9	1.2		BDL	3.0
Copper	287	1.2		7.7	1.2
Lead	97.1	3.0		256	1.2

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 3
Received: 01/14/91

Results by Sample

Work Order # 91-01-066

SAMPLE ID B7S

FRACTION 02A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:50:00 Category

ANALYST DL_IH_JE

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.0	mg/kg		
Arsenic	0.67	0.30			
Barium	72.7	1.2			
Beryllium	0.44	0.30			
Cadmium	0.27	0.12			
Chromium	6.2	0.6			
Cobalt	1.8	1.2			
Copper	3944	1.2			
Lead	166	3.0			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P-4
Received: 01/14/91

Work Order # 91-01-066

Results by Sample

SAMPLE ID B7E

FRACTION 03A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 16:50:00 Category

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	0.66	mg/kg		
Arsenic	0.27			
Barium	44.9	1.1		
Beryllium	0.39	0.28		
Cadmium	BDL	0.11		
Chromium	7.1	0.6		
Cobalt	2.0	1.1		
Copper	31.5	1.1		
Lead	14.1	2.8		

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Antimony	BDL	2.8	Mercury	BDL	0.07
Arsenic	0.66	0.27	Nickel	1.7	1.1
Barium	44.9	1.1	Selenium	BDL	0.27
Beryllium	0.39	0.28	Silver	BDL	1.1
Cadmium	BDL	0.11	Thallium	BDL	0.27
Chromium	7.1	0.6	Tin	<5.4	2.8
Cobalt	2.0	1.1	Vanadium	7.6	1.1
Copper	31.5	1.1	Zinc	34.8	1.1
Lead	14.1	2.8			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

6
Received: 01/14/91

Results by Sample

Work Order # 91-01-066

SAMPLE ID B7W

FRACTION 04A TEST CODE AP9TH NAME APPENDIX IX TRACK METALS
Date & Time Collected 01/09/91 16:50:00 Category

ANALYST DL_JH_JE

COMPOUND	FACTOR	UNITS	ma/kg	VERIFIED	JHM
Antimony	BDL	3.0		Mercury	
Arsenic	0.73	0.30		Nickel	0.08
Barium	45.2	1.2		Selenium	1.2
Beryllium	BDL	0.30		Silver	0.30
Cadmium	3.22	0.12		Thallium	BDL
Chromium	3.7	0.6		Tin	1.2
Cobalt	1.8	1.2		Vanadium	0.30
Copper	1223	1.2		Zinc	3.0
Lead	41.6	3.0			BDL

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 7
Received: 01/14/91

Work Order # 91-01-066

Results by Sample

SAMPLE ID B8N

FRACTION 05A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:05:00 Category

ANALYST DL IH JE

COMPOUND	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	2.9	COMPOUND	DET LIMIT
Arsenic	4.36	0.29	Mercury	BDL 0.08
Barium	54.6	1.2	Nickel	3.9 1.2
Beryllium	BDL	0.29	Selenium	BDL 0.29
Cadmium	0.50	0.12	Silver	BDL 1.2
Chromium	5.3	0.6	Thallium	BDL 0.29
Cobalt	BDL	1.2	Tin	BDL 2.9
Copper	885	1.2	Vanadium	3.9 1.2
Lead	73.4	2.9	Zinc	551 1.2

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

P 8
Received: 01/14/91

SAMPLE ID BSS

Work Order # 91-01-066

Results by Sample

FRACTION 06A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:05:00 Category

ANALYST DL_IH_JH

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	BDL	3.4			
Arsenic	2.01	0.33			
Barium	39.8	1.4			
Beryllium	BDL	0.34			
Cadmium	BDL	0.14			
Chromium	4.2	0.7			
Cobalt	BDL	1.4			
Copper	144.5	1.4			
Lead	10.6	3.4			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.

F 9
Received: 01/14/91

Results by Sample

Work Order # 91-01-066

SAMPLE ID BSE

FRACTION 07A TEST CODE AP9TH NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:05:00 Category

ANALYST DL_IH_JE

COMPOUND	FACTOR	UNITS	mg/kg	VERIFIED	JHM
Antimony	DET LIMIT	COMPOUND			
Arsenic	BDL	Mercury			
Barium	0.90	Nickel			
Beryllium	64.1	Selenium			
Cadmium	0.53	Silver			
Chromium	0.13	Thallium			
Cobalt	22.7	Tin			
Copper	2.6	Vanadium			
Lead	37.5	Zinc			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/14/91

SAMPLE ID BSW

FRACTION 08A TEST CODE APP9TH NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:05:00 Category

Results by Sample

ANALYST DL_IH_JE

COMPOUND	RESULT	FACTOR	UNITS	mq/kg	VERIFIED	JHM
Antimony	BDL	3.1	Mercury	0.08		
Arsenic	0.92	0.31	Nickel	1.2		
Barium	68.3	1.2	Selenium	0.31		
Beryllium	0.86	0.31	Silver	1.2		
Cadmium	0.42	0.12	Thallium	0.31		
Chromium	8.6	0.6	Tin	3.1		
Cobalt	2.7	1.2	Vanadium	10.3		
Copper	5.88	1.2	Zinc	17.2		
Lead	12.5	3.1				

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

age _____
Received: 01/14/91

Results by _____

SAMPLE ID B9N

FRACTION 09A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:30:00 Category

ANALYST DL_IH_JE	FACTOR	UNITS	VERIFIED	JHS
COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT
Antimony	BDL	3.5	Mercury	BDL
Arsenic	0.97	0.35	Nickel	6.2
Barium	65.4	1.4	Selenium	<0.56 X
Beryllium	0.87	0.35	Silver	BDL
Cadmium	BDL	0.14	Thallium	BDL
Chromium	17.6	0.7	Tin	<4 X
Cobalt	3.4	1.4	Vanadium	15.0
Copper	172	1.4	Zinc	96.2
Lead	17.0	3.5		

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Antimony	BDL	3.5	Mercury	BDL	0.09
Arsenic	0.97	0.35	Nickel	6.2	1.4
Barium	65.4	1.4	Selenium	0.35	0.35
Beryllium	0.87	0.35	Silver	BDL	1.4
Cadmium	BDL	0.14	Thallium	BDL	0.35
Chromium	17.6	0.7	Tin	<4 X	3.5
Cobalt	3.4	1.4	Vanadium	15.0	1.4
Copper	172	1.4	Zinc	96.2	1.4
Lead	17.0	3.5			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.

Received: 01/14/91

Results by Sample

SAMPLE ID B9S

FRACTION 10A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:30:00 Category

ANALYST DL_IH_JB

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	1	mg/kg		
Arsenic	0.78	3.3	mg/kg		
Barium	116	1.3	mg/kg		
Beryllium	0.40	0.33	mg/kg		
Cadmium	BDL	0.13	mg/kg		
Chromium	7.5	0.7	mg/kg		
Cobalt	1.8	1.3	mg/kg		
Copper	336	1.3	mg/kg		
Lead	8.2	3.3	mg/kg		

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/14/91

Results by Sample

SAMPLE ID B9E

FRACTION 11A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:30:00 Category

ANALYST DL_IH_JK

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.0	mg/kg		
Arsenic	1.25	0.30			
Barium	38.2	1.2			
Beryllium	BDL	0.30			
Cadmium	BDL	0.12			
Chromium	4.9	0.6			
Cobalt	BDL	1.2			
Copper	13317	1.2			
Lead	107	3.0			

ANALYST DL_IH_JK

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Mercury	BDL	0.08	mg/kg		
Nickel	2.3	1.2			
Selenium	BDL	0.30			
Silver	BDL	1.2			
Thallium	BDL	0.30			
Tin	6.7	3.0			
Vanadium	2.1	1.2			
Zinc	30.8	1.2			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/14/91

SAMPLE ID B9W

FRACTION 12A TEST CODE APP9TH NAME APPENDIX IX TRACK METALS
Date & Time Collected 01/09/91 17:30:00 Category

ANALYST DL_JH_JE

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	1.56	3.4	Mercury	0.09
Arsenic	0.34	0.34	3.4	Nickel	1.3
Barium	70.0	1.3	mg/kg	Selenium	0.34
Beryllium	0.37	0.34	mg/kg	Silver	1.3
Cadmium	0.75	0.13	mg/kg	Thallium	0.34
Chromium	3.1	0.7	mg/kg	Tin	3.4
Cobalt	1.7	1.3	mg/kg	Vanadium	1.3
Copper	4835	1.3	mg/kg	Zinc	1.3
Lead	37.5	3.4	mg/kg		

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/14/91

ANALYST DL_IH_JR

SAMPLE ID B10N

FRACTION 13A TEST CODE AP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:55:00 Category

RESULTS by Sample

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED
Antimony	BDL	3.4	mg/kg	JHM
Arsenic	1.60	0.33		
Barium	119	1.3		
Beryllium	0.53	0.34		
Cadmium	0.14	0.13		
Chromium	10.9	0.7		
Cobalt	3.3	1.3		
Copper	4.66	1.3		
Lead	37.2	3.4		

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED
Mercury	0.09	0.09		
Nickel	3.1	1.3		
Selenium	<1.3	1		
Silver	BDL	1.3		
Thallium	BDL	0.33		
Tin	<9	1		
Vanadium	7.7	1.3		
Zinc	36.6	1.3		

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Pad
Received: 01/14/91

SAMPLE ID B10S

FRACTION 14A TEST CODE APP7M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:55:00 Category

Results by Sample

Pad
Ord : 91

-0.01

ANALYST DL_IH_JE

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL		mg/kg		
Arsenic	1.84	3.2			
Barium	1.06	0.32			
Beryllium	0.34	1.3			
Cadmium	2.30	0.32			
Chromium	2.30	0.13			
Cobalt	11.6	0.6			
Copper	1.6	1.3			
Lead	2558	1.3			
	1.61	3.2			

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Mercury	BDL		mg/kg		
Nickel	5.7	BDL			0.08
Selenium	BDL				1.3
Silver	2.5	BDL			0.32
Thallium	BDL				1.3
Tin	7.2	BDL			0.32
Vanadium	5.4	BDL			3.2
Zinc	137	BDL			1.3

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Page _____
Reported: 01/14/91

Results by Sample

SAMPLE ID B10E

FRACTION 15A TEST CODE APP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:55:00 Category

ANALYST DL_IH_JE

COMPOUND	RESULT	FACTOR	UNITS	UNITS	VERIFIED	JHM
Antimony	BDL	1	mg/kg	mg/kg		
Arsenic	1.28	3.3	Mercury	BDL		0.09
Barium	71.6	0.34	Nickel	4.2		1.3
Beryllium	0.80	1.3	Selenium	<1.7	X	0.34
Cadmium	0.14	0.33	Silver	BDL		1.3
Chromium	16.2	0.13	Thallium	BDL		0.34
Cobalt	3.3	0.7	Tin	<9.2	X	3.3
Copper	24.0	1.3	Vanadium	10.5		1.3
Lead	26.9	3.3	Zinc	55.7		1.3

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/14/91

SAMPLE ID B10W

Results by Sample

FRACTION 16A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 17:55:00 Category

ANALYST DL_IH_JB

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	3.2	mg/kg		
Arsenic	1.52	0.32			
Barium	74.3	1.3			
Beryllium	0.75	0.32			
Cadmium	BDL	0.13			
Chromium	12.9	0.6			
Cobalt	2.8	1.3			
Copper	70.1	1.3			
Lead	16.8	3.2			

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Mercury	BDL	3.2	mg/kg		
Nickel	2.7	0.32			
Selenium	<0.51	1.3			
Silver	BDL	0.32			
Thallium	BDL	0.32			
Tin	<6.0	1.3			
Vanadium	13.3	1.3			
Zinc	23.4	1.3			

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/14/91

Results by Sample

SAMPLE ID BKGD " B "

FRACTION 18A TEST CODE AP97M NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 18:45:00 Category

ANALYST DL IH JR

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Antimony	BDL	1	mg/kg		
Arsenic	1.03	2.6	mg/kg		
Barium	21.1	0.28	mg/kg		
Beryllium	BDL	1.1	mg/kg		
Cadmium	BDL	0.28	mg/kg		
Chromium	BDL	0.11	mg/kg		
Cobalt	5.4	0.6	mg/kg		
Copper	BDL	1.1	mg/kg		
Lead	9.4	2.8	mg/kg		

COMPOUND	RESULT	FACTOR	UNITS	VERIFIED	JHM
Mercury	BDL	0.07	mg/kg		
Nickel	1.1	1.1	mg/kg		
Selenium	BDL	0.28	mg/kg		
Silver	BDL	1.1	mg/kg		
Thallium	BDL	0.28	mg/kg		
Tin	BDL	2.8	mg/kg		
Vanadium	7.3	1.1	mg/kg		
Zinc	4.2	1.1	mg/kg		

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/14/91

02/08/91 10:21

ENVIRONMENTAL TEC. ENG., INC.

DEFINITIONS AND EXPLANATIONS:

1. THE " X " INDICATES A MATRIX INTERFERENCE WHICH MAY REQUIRE A DILUTION OR WHICH PREVENTS THE REPORTING OF A RESULT. DETECTION LIMITS HAVE BEEN ADJUSTED WHERE APPLICABLE.

Received: 01/14/91

SAMPLE ID BKGD "A"

FRACTION 17A TEST CODE APP9TM NAME APPENDIX IX TRACE METALS
Date & Time Collected 01/09/91 18:45:00 Category

ANALYST DL_IH_JE

Results by Sample

COMPOUND	RESULT	DET LIMIT	UNITS	mq/kg	VERIFIED	JHM
Antimony	BDL	2.9	COMPOUND		RESULT	DET LIMIT
Arsenic	0.64	0.29	Mercury		BDL	0.08
Barium	19.3	1.2	Nickel		BDL	1.2
Beryllium	BDL	0.29	Selenium		BDL	0.29
Cadmium	BDL	0.12	Silver		BDL	1.2
Chromium	4.9	0.6	Thallium		BDL	0.29
Cobalt	BDL	1.2	Tin		BDL	2.9
Copper	BDL	1.2	Vanadium		6.2	1.2
Lead	9.5	2.9	Zinc		5.3	1.2

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

FLOYD

816 East Durst Street, Greenwood, S.C.

Phone (803)229-5211 Fax (803)229-7844

APPENDIX VIII
ORGANICS
1ST SCREENING

age _____
Received: 01/14/91

02/13/91 12:55:57

REPORT ENVIRONMENTAL TEC. ENG., INC. PREPARED Davis & Floyd, Inc.
TO POST OFFICE BOX 1867 BY P.O. Drawer 428
1445 PISGAH CHURCH RD. Greenwood, S.C. 29648
LEXINGTON, S.C. 29072
ATTN MICHAEL YOUNG

WORK ID JOB # 7488.00
P.O. #
TAKEN ETC
TYPE SOIL
NUMBER OF SAMPLES 5

John M. McCord
CERTIFIED BY

PHONE (803)-229-5211

Comments:

WE ARE PLEASED TO PROVIDE THIS CERTIFIED REPORT OF ANALYSES.
FEEL FREE TO TELEPHONE IF FURTHER EXPLANATION IS REQUIRED.
UNLESS OTHER ARRANGEMENTS HAVE BEEN MADE, SAMPLES WILL BE
DISPOSED OF OR RETURNED 28 DAYS FROM THE DATE OF THIS REPORT.

SAMPLE IDENTIFICATION

01 B1N
02 B3N
03 B5N
04 B7N
05 B9N

DATE COLLECTED

01/09/91 14:00:00
01/09/91 15:05:00
01/09/91 16:00:00
01/09/91 16:50:00
01/09/91 17:30:00

age
Received: 01/14/91

Results by Sample

SAMPLE ID BIN

FRACTION 01A TEST CODE APPV09 NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 14:00:00 Category

ANALYST PAP

ANALYZED 01/14/91

FACTOR 1

COMPOUND	RESULT	DET LIMIT	UNITS ug/kg
Chloromethane	BDL	10	
Bromomethane	BDL	10	
Vinyl Chloride	BDL	10	
Chloroethane	BDL	10	
Methylene Chloride	BDL	5.0	
Acetone	BDL	10	
Carbon Disulfide	BDL	5.0	
Trichlorofluoromethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
1,1-Dichloroethane	BDL	5.0	
1,2-Dichloroethene total	BDL	5.0	
Chloroform	BDL	5.0	
1,2-Dichloroethane	BDL	5.0	
2-Butanone	BDL	10	
1,1,1-Trichloroethane	BDL	5.0	
Carbon Tetrachloride	BDL	5.0	
Vinyl Acetate	BDL	10	
Bromodichloromethane	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
Trichloroethene	BDL	5.0	
Dibromochloromethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Benzene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Bromoform	BDL	5.0	
4-Methyl-2-Pentanone	BDL	10	
2-Hexanone	BDL	10	

VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Tetrachloroethene	BDL	5.0
1,1,2,2-Tetrachloroethane	BDL	5.0
Toluene	BDL	5.0
Chlorobenzene	BDL	5.0
Ethylbenzene	BDL	5.0
Styrene	BDL	5.0
Xylene total	BDL	5.0
Allyl Chloride	BDL	10
1,2-Dibromo-3-chloropropane	BDL	10
1,2-Dibromoethane	BDL	10
trans-1,4-Dichloro-2-butene	BDL	10
Dichlorodifluoromethane	BDL	0
Ethyl Methacrylate	BDL	10
Methacrylonitrile	BDL	10
Dibromomethane	BDL	10
Iodomethane	BDL	10
Methyl Methacrylate	BDL	10
Pentachloroethane	BDL	10
Ethyl Cyanide	BDL	10
1,1,1,2-Tetrachloroethane	BDL	10
1,2,3-Trichloropropane	BDL	10
Acetonitrile	BDL	100
Acrylonitrile	BDL	100
Acrolein	BDL	100
1,4-Dioxane	BDL	100
Isobutyl Alcohol	BDL	100
2-Chloro-1,3-butadiene	BDL	10

Received: 01/14/91

SAMPLE ID BIN

FRACTION 01A TEST CODE APPVOA NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 14:00:00 Category

Results by Sample

Continued from Above

NOTES AND DEFINITIONS FOR THIS REPORT

- ND = not detected
- BDL = below the required detection limit.
- LS = library search on the target compound.
- B = compound detected in the method blank.
- J = estimate below the required det limit.

age
Revised: 01/14/91

Results by Sample

SAMPLE ID B3N

FRACTION 02A TEST CODE APPROA NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 15:05:00 Category

VERIFIED JHM

ANALYST	PAP	ANALYZED 01/14/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT	RESULT	DET LIMIT
							Tetrachloroethene	BDL	BDL	BDL	5.0
							1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	5.0
							Toluene	BDL	BDL	BDL	5.0
							Chlorobenzene	BDL	BDL	BDL	5.0
							Ethylbenzene	BDL	BDL	BDL	5.0
							Styrene	BDL	BDL	BDL	5.0
							Xylene total	BDL	BDL	BDL	5.0
							Allyl Chloride	BDL	BDL	BDL	10
							1,2-Dibromo-3-chloropropane	BDL	BDL	BDL	10
							1,2-Dibromoethane	BDL	BDL	BDL	10
							trans-1,4-Dichloro-2-butene	BDL	BDL	BDL	10
							Dichlorodifluoromethane	BDL	BDL	BDL	0
							Ethyl Methacrylate	BDL	BDL	BDL	10
							Methacrylonitrile	BDL	BDL	BDL	10
							Dibromomethane	BDL	BDL	BDL	10
							Iodomethane	BDL	BDL	BDL	10
							Methyl Methacrylate	BDL	BDL	BDL	10
							Pentachloroethane	BDL	BDL	BDL	10
							Ethyl Cyanide	BDL	BDL	BDL	10
							1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	10
							1,2,3-Trichloropropane	BDL	BDL	BDL	10
							Acetonitrile	BDL	BDL	BDL	100
							Acrylonitrile	BDL	BDL	BDL	100
							Acrolein	BDL	BDL	BDL	100
							1,4-Dioxane	BDL	BDL	BDL	100
							Isobutyl Alcohol	BDL	BDL	BDL	100
							2-Chloro-1,3-butadiene	BDL	BDL	BDL	10
							2-Hexanone	BDL	BDL	BDL	10

age
Received: 01/14/91

Continued From Above

Results by Sample

SAMPLE ID B3N

FRACTION 02A TEST CODE APPVOA NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 15:05:00 Category

NOTES AND DEFINITIONS FOR THIS REPORT

- ND = not detected
- BDL = below the required detection limit.
- LS = library search on the target compound.
- B = compound detected in the method blank.
- J = estimate below the required det limit.

Sample ID BSN
Received: 01/14/91

SAMPLE ID BSN

FRACTION 03A TEST CODE APP90A NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 16:00:00 Category

Results by Sample

ANALYST	PAP	ANALYZED 01/14/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT
							Tetrachloroethene	BDL	5.0
							1,1,2,2-Tetrachloroethane	BDL	5.0
							Toluene	BDL	5.0
							Chlorobenzene	BDL	5.0
							Ethylbenzene	BDL	5.0
							Styrene	BDL	5.0
							Xylene total	BDL	5.0
							Allyl Chloride	BDL	10
				4.3		5.0	1,2-Dibromo-3-chloropropane	BDL	10
							1,2-Dibromoethane	BDL	10
							trans-1,4-Dichloro-2-butene	BDL	10
							Dichlorodifluoromethane	BDL	0
							Ethyl Methacrylate	BDL	10
							Methacrylonitrile	BDL	10
							Dibromomethane	BDL	10
							Iodomethane	BDL	10
							Methyl Methacrylate	BDL	10
							Pentachloroethane	BDL	10
							Ethyl Cyanide	BDL	10
							1,1,1,2-Tetrachloroethane	BDL	10
							1,2,3-Trichloropropane	BDL	10
							Acetonitrile	BDL	100
							Acrylonitrile	BDL	100
							Acrolein	BDL	100
							1,4-Dioxane	BDL	100
							Isobutyl Alcohol	BDL	100
							2-Chloro-1,3-butadiene	BDL	10
							2-Hexanone	BDL	10

age _____
Received: 01/14/91

WO _____ Date _____ Job
Continued From Above

Results by Sample

SAMPLE ID B5N

FRACTION 03A TEST CODE AP9VOA NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 16:00:00 Category

NOTES AND DEFINITIONS FOR THIS REPORT

- ND = not detected
- BDL = below the required detection limit.
- LS = library search on the target compound.
- B = compound detected in the method blank.
- J = estimate below the required det limit.

age
Received: 01/14/91

Results by Sample

SAMPLE ID B7N

FRACTION 04A TEST CODE AP9VOA NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 16:50:00 Category

VERIFIED JHM

ANALYST	PAP	ANALYZED 01/14/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT
							Tetrachloroethene	BDL	5.0
							1,1,2,2-Tetrachloroethane	BDL	5.0
							Toluene	BDL	5.0
							Chlorobenzene	BDL	5.0
							Ethylbenzene	BDL	5.0
							Styrene	BDL	5.0
							Xylene total	BDL	5.0
							Allyl Chloride	BDL	10
							1,2-Dibromo-3-chloropropane	BDL	10
							1,2-Dibromoethane	BDL	10
							trans-1,4-Dichloro-2-butene	BDL	10
							Dichlorodifluoromethane	BDL	0
							Ethyl Methacrylate	BDL	10
							Methacrylonitrile	BDL	10
							Dibromomethane	BDL	10
							Iodomethane	BDL	10
							Methyl Methacrylate	BDL	10
							Pentachloroethane	BDL	10
							Ethyl Cyanide	BDL	10
							1,1,1,2-Tetrachloroethane	BDL	10
							1,2,3-Trichloropropane	BDL	10
							Acetonitrile	BDL	100
							Acrylonitrile	BDL	100
							Acrolein	BDL	100
							1,4-Dioxane	BDL	100
							Isobutyl Alcohol	BDL	100
							2-Chloro-1,3-butadiene	BDL	10
							Benzene	BDL	10

Received: 01/14/91

SAMPLE ID B7N

Continued from Above

FRACTION 04A TEST CODE APPVOA NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 16:50:00 Category

NOTES AND DEFINITIONS FOR THIS REPORT

ND = not detected

BDL = below the required detection limit.

LS = library search on the target compound.

B = compound detected in the method blank.

J = estimate below the required det limit.

Results by Sample

Received: 01/14/91

SAMPLE ID B9N

FRACTION 05A

TEST CODE APPROVED

Date & Time Collected 01/09/91 17:30:00 Category

Results by Sample

ANALYST PAP

ANALYZED 01/14/91

FACTOR 1

UNITS ug/kg

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Chloromethane	BDL	10	Tetrachloroethene	BDL	5.0
Bromomethane	BDL	10	1,1,2,2-Tetrachloroethane	BDL	5.0
Vinyl Chloride	BDL	10	Toluene	BDL	5.0
Chloroethane	BDL	10	Chlorobenzene	BDL	5.0
Methylene Chloride	BDL	5.0	Ethylbenzene	BDL	5.0
Acetone	24	10	Styrene	BDL	5.0
Carbon Disulfide	BDL	5.0	Xylene total	BDL	5.0
Trichlorofluoromethane	BDL	5.0	Allyl Chloride	BDL	5.0
1,1-Dichloroethene	BDL	5.0	1,2-Dibromo-3-chloropropane	BDL	10
1,2-Dichloroethene total	BDL	5.0	1,2-Dibromoethane	BDL	10
Chloroform	BDL	5.0	trans-1,4-Dichloro-2-butene	BDL	10
1,2-Dichloroethane	BDL	5.0	Dichlorodifluoromethane	BDL	0
2-Butanone	BDL	10	Ethyl Methacrylate	BDL	10
1,1,1-Trichloroethane	BDL	5.0	Methacrylonitrile	BDL	10
Carbon Tetrachloride	BDL	5.0	Dibromomethane	BDL	10
Vinyl Acetate	BDL	5.0	Iodomethane	BDL	10
Bromodichloromethane	BDL	10	Methyl Methacrylate	BDL	10
1,2-Dichloropropane	BDL	5.0	Pentachloroethane	BDL	10
cis-1,3-Dichloropropene	BDL	5.0	Ethyl Cyanide	BDL	10
Trichloroethene	BDL	5.0	1,1,1,2-Tetrachloroethane	BDL	10
Dibromochloromethane	BDL	5.0	1,2,3-Trichloropropane	BDL	10
1,1,2-Trichloroethane	BDL	5.0	Acetonitrile	BDL	100
Benzene	BDL	5.0	Acrylonitrile	BDL	100
trans-1,3-Dichloropropene	BDL	5.0	Acrolein	BDL	100
Bromoform	BDL	5.0	1,4-Dioxane	BDL	100
4-Methyl-2-Pentanone	BDL	10	Isobutyl Alcohol	BDL	100
2-Hexanone	BDL	10	2-Chloro-1,3-butadiene	BDL	10

VERIFIED JHM

Received: 01/14/91
SAMPLE ID B9N

Results by Sample
Continued From Above

FRACTION 05A TEST CODE AP9VOA NAME APPENDIX IX VOLATILES
Date & Time Collected 01/09/91 17:30:00 Category

NOTES AND DEFINITIONS FOR THIS REPORT

- ND = not detected
- BDL = below the required detection limit.
- LS = library search on the target compound.
- B = compound detected in the method blank.
- J = estimate below the required det limit.

age
Received: 01/14/91

02/08/91 1:10:09

REPORT ENVIRONMENTAL TEC. ENG., INC. PREPARED Davis & Floyd, Inc.
TO POST OFFICE BOX 1867 BY P.O. Drawer 428
1445 PISGAH CHURCH RD. Greenwood, S.C. 29648
LEXINGTON, S.C. 29072
ATTN MICHAEL YOUNG

WORK ID JOB # 7488.00

P.O. #

TAKEN ETE

TYPE SOIL

NUMBER OF SAMPLES 24

Comments:

WE ARE PLEASED TO PROVIDE THIS CERTIFIED REPORT OF ANALYSES.
FEEL FREE TO TELEPHONE IF FURTHER EXPLANATION IS REQUIRED.
UNLESS OTHER ARRANGEMENTS HAVE BEEN MADE, SAMPLES WILL BE
DISPOSED OF OR RETURNED 28 DAYS FROM THE DATE OF THIS REPORT.

John H. McCord
CERTIFIED BY
JOHN MCCORD

SAMPLE IDENTIFICATION

SAMPLE IDENTIFICATION	DATE COLLECTED	SAMPLE IDENTIFICATION	DATE COLLECTED
01 B1N	01/09/91 14:00:00	22 B6S	01/09/91 16:25:00
02 B1S	01/09/91 14:05:00	23 B6E	01/09/91 16:25:00
03 B1E	01/09/91 14:05:00	24 B6W	01/09/91 16:25:00
04 B1W	01/09/91 14:00:00		
05 B2N	01/09/91 14:45:00		
06 B2S	01/09/91 14:50:00		
07 B2E	01/09/91 14:55:00		
08 B2W	01/09/91 14:45:00		
09 B3N	01/09/91 15:05:00		
10 B3S	01/09/91 15:05:00		
11 B3E	01/09/91 15:10:00		
12 B3W	01/09/91 15:10:00		
13 B4N	01/09/91 15:30:00		
14 B4S	01/09/91 15:30:00		
15 B4E	01/09/91 15:30:00		
16 B4W	01/09/91 15:30:00		
17 B5N	01/09/91 16:00:00		
18 B5S	01/09/91 16:00:00		
19 B5E	01/09/91 16:00:00		
20 B5W	01/09/91 16:00:00		
21 B6N	01/09/91 16:25:00		

Received: 01/14/91

02/08/91 11:20:21

REPORT ENVIRONMENTAL TEC. ENG., INC. PREPARED Davis & Floyd, Inc.
TO POST OFFICE BOX 1867 BY P.O. Drawer 428
1445 PISGAH CHURCH RD. Greenwood, S.C. 29648
LEXINGTON, S.C. 29072
ATTEN MICHAEL YOUNG

WORK ID JOB # 7488.00
P.O. #
TAKEN ETC
TYPE SOIL
NUMBER OF SAMPLES 18

JOHN MCCORD

Comments:

WE ARE PLEASED TO PROVIDE THIS CERTIFIED REPORT OF ANALYSES.
FEEL FREE TO TELEPHONE IF FURTHER EXPLANATION IS REQUIRED.
UNLESS OTHER ARRANGEMENTS HAVE BEEN MADE, SAMPLES WILL BE
DISPOSED OF OR RETURNED 28 DAYS FROM THE DATE OF THIS REPORT.

SAMPLE IDENTIFICATION

		DATE COLLECTED
01	B7N	01/09/91 16:50:00
02	B7S	01/09/91 16:50:00
03	B7E	01/09/91 16:50:00
04	B7W	01/09/91 16:50:00
05	B8N	01/09/91 17:05:00
06	B8S	01/09/91 17:05:00
07	B8E	01/09/91 17:05:00
08	B8W	01/09/91 17:05:00
09	B9N	01/09/91 17:30:00
10	B9S	01/09/91 17:30:00
11	B9E	01/09/91 17:30:00
12	B9W	01/09/91 17:30:00
13	B10N	01/09/91 17:55:00
14	B10S	01/09/91 17:55:00
15	B10E	01/09/91 17:55:00
16	B10W	01/09/91 17:55:00
17	BKGD "A"	01/09/91 18:45:00
18	BKGD "B"	01/09/91 18:45:00

Page _____
Printed: 01/14/91

Results by Sample

SAMPLE ID B1W

FRACTION 04B TEST CODE SW8240 NAME HSL VOA (SW846 8240)
Date & Time Collected 01/09/91 14:00:00 Category

ANALYST	PAP	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT
							1,2-Dichloropropane	BDL	5.0
							cis-1,3-Dichloropropene	BDL	5.0
							Trichloroethene	BDL	5.0
							Dibromochloromethane	BDL	5.0
							1,1,2-Trichloroethane	BDL	5.0
							Benzene	BDL	5.0
							trans-1,3-Dichloropropene	BDL	5.0
							Bromoform	BDL	5.0
							1,1-Dichloroethane	BDL	5.0
							1,2-Dichloroethane total	BDL	5.0
							2-Hexanone	BDL	10
							Tetrachloroethene	BDL	5.0
							1,1,2,2-Tetrachloroethane	BDL	10
							Toluene	BDL	5.0
							Chlorobenzene	BDL	5.0
							Ethylbenzene	BDL	5.0
							Styrene	BDL	5.0
							Xylene total	BDL	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

J = estimate below the required det limit.

B = compound detected in method blank.

D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 9 ug/kg ACETONE.

Sample Received: 01/14/91

Results by Sample

SAMPLE ID B2E TEST CODE SW8240 NAME HSL VOA (SW846 8240)
Date & Time Collected 01/09/91 14:55:00 Category

Wol...rde... 91-- J65

VERIFIED JHM

ANALYST	PAP	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT	RESULT	DET LIMIT	
							1,2-Dichloropropane	BDL	5.0	BDL	5.0	
							cis-1,3-Dichloropropene	BDL	5.0	BDL	5.0	
							Trichloroethene	BDL	5.0	BDL	5.0	
							Dibromochloromethane	BDL	5.0	BDL	5.0	
							1,1,2-Trichloroethane	BDL	5.0	BDL	5.0	
							Methylene Chloride	2 J	5.0	BDL	5.0	
							Acetone	14 B	10	BDL	5.0	
							Carbon Disulfide	BDL	5.0	BDL	5.0	
							1,1-Dichloroethene	BDL	5.0	BDL	5.0	
							1,1-Dichloroethane	BDL	5.0	BDL	10	
							1,2-Dichloroethene total	BDL	5.0	BDL	10	
							Chloroform	BDL	5.0	BDL	5.0	
							1,2-Dichloroethane	BDL	5.0	BDL	5.0	
							2-Butanone	BDL	10	Toluene	BDL	5.0
							1,1,1-Trichloroethane	BDL	5.0	Chlorobenzene	BDL	5.0
							Carbon Tetrachloride	BDL	5.0	Ethylbenzene	BDL	5.0
							Vinyl Acetate	BDL	10	Styrene	BDL	5.0
							Bromodichloromethane	BDL	5.0	xylene total	BDL	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

- NA = not analyzed
- BDL = below the required detection limit.
- J = estimate below the required det limit.
- B = compound detected in method blank.
- D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 9 ug/kg ACETONE.

Received: 01/14/91

Results by Sample

SAMPLE ID B3N

FRACTION 09B TEST CODE SW8240 NAME HSL VOA (SW846 8240)
Date & Time Collected 01/09/91 15:05:00 Category

VERIFIED JHM

ANALYST	PAP	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT	DET LIMIT	
Chloromethane		BDL	10	1,2-Dichloropropane		BDL	cis-1,3-Dichloropropene	BDL	5.0	5.0	
Bromomethane		BDL	10	Trichloroethene		BDL	Dibromochloromethane	BDL	5.0	5.0	
Vinyl Chloride		BDL	10	1,1,2-Trichloroethane		BDL	Benzene	BDL	5.0	5.0	
Chloroethane		BDL	10	trans1,3-Dichloropropene		BDL	Bromoform	BDL	5.0	5.0	
Methylene Chloride		4 J	5.0	Bromoform		BDL	1,1-Dichloroethene	BDL	5.0	5.0	
Acetone		18 B	10	4-Methyl-2-Pentanone		BDL	2-Hexanone	BDL	5.0	5.0	
Carbon Disulfide		BDL	5.0	Tetrachloroethene		BDL	Toluene	BDL	5.0	5.0	
1,1-Dichloroethene		BDL	5.0	1,1,2,2-Tetrachloroethane		BDL	Chlorobenzene	BDL	5.0	5.0	
1,2-Dichloroethene total		BDL	5.0	Styrene		BDL	Styrene	BDL	5.0	5.0	
Chloroform		BDL	5.0	Xylene total		BDL	Xylene total	BDL	5.0	5.0	
1,2-Dichloroethane		BDL	5.0								
2-Butanone		BDL	10								
1,1,1-Trichloroethane		BDL	5.0								
Carbon Tetrachloride		BDL	5.0								
Vinyl Acetate		BDL	10								
Bromodichloromethane		BDL	5.0								

NOTES AND DEFINITIONS FOR THIS REPORT

- NA = not analyzed
BDL = below the required detection limit.
J = estimate below the required det limit.
B = compound detected in method blank.
D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 9 ug/kg ACETONE.

age
Received: 01/14/91

SAMPLE ID B6W

FRACTION 24B TEST CODE SW8240 NAME HSL VOA (SW846 8240)
Date & Time Collected 01/09/91 16:25:00 Category

Results by Sample

ANALYST	PAP	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg
COMPUND		RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Chloromethane		BDL	10	1,2-Dichloropropane	BDL	5.0
Bromomethane		BDL	10	cis-1,3-Dichloropropene	BDL	5.0
Vinyl Chloride		BDL	10	Trichloroethene	BDL	5.0
Chloroethane		BDL	10	Dibromochloromethane	BDL	5.0
Methylene Chloride		BDL	10	1,1,2-Trichloroethane	BDL	5.0
Acetone	3 J	5.0		Benzene	BDL	5.0
Carbon Disulfide	17 B	10		trans1,3-Dichloropropene	BDL	5.0
1,1-Dichloroethene	BDL	5.0		Bromoform	BDL	5.0
1,1-Dichloroethane	BDL	5.0		4-Methyl-2-Pentanone	BDL	5.0
1,2-Dichloroethane total	BDL	5.0		2-Hexanone	BDL	5.0
Chloroform	BDL	5.0		Tetrachloroethene	BDL	5.0
1,2-Dichloroethane	BDL	5.0		1,1,2,2-Tetrachloroethane	BDL	5.0
2-Butanone	BDL	10		Toluene	BDL	10
1,1,1-Trichloroethane	BDL	5.0		Chlorobenzene	BDL	5.0
Carbon Tetrachloride	BDL	5.0		Ethylbenzene	BDL	5.0
Vinyl Acetate	BDL	10		Styrene	BDL	5.0
Bromodichloromethane	BDL	5.0	Xylene total	BDL	5.0	

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

J = estimate below the required det limit.

B = compound detected in method blank.

D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 9 ug/kg ACETONE.

age
Received: 01/14/91

Results by Sample

SAMPLE ID B7E

FRACTION 03B TEST CODE SW8240 NAME HSL VOA (SW846 8240)
Date & Time Collected 01/09/91 16:50:00 Category

VERIFIED JHM

ANALYST	PART	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg
COMPOUND		RESULT	DET LIMIT	1	COMPOUND	
Chloromethane		6	10	1	1,2-Dichloropropane	
Bromomethane		BDL	10	1	cis-1,3-Dichloropropene	
Vinyl Chloride		BDL	10	1	Trichloroethene	
Chloroethane		BDL	10	1	Dibromochloromethane	
Methylene Chloride		4 J	5.0	1	1,1,2-Trichloroethane	
Acetone		34 B	10	1	Benzene	
Carbon Disulfide		BDL	5.0	1	trans1,3-Dichloropropene	
1,1-Dichloroethene		BDL	5.0	1	Bromoform	
1,1-Dichloroethane		BDL	5.0	1	4-Methyl-2-Pentanone	
1,2-Dichloroethene total		BDL	5.0	1	2-Hexanone	
Chloroform		BDL	5.0	1	Tetrachloroethene	
1,2-Dichloroethane		BDL	5.0	1	1,1,2,2-Tetrachloroethane	
2-Butanone		BDL	10	1	Toluene	
1,1,1-Trichloroethane		BDL	5.0	1	Chlorobenzene	
Carbon Tetrachloride		BDL	5.0	1	Ethylbenzene	
Vinyl Acetate		BDL	10	1	Styrene	
Bromodichloromethane		BDL	5.0	1	Xylene total	

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

J = estimate below the required det limit.

B = compound detected in method blank.

D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 9 ug/kg ACETONE.

Received: 01/14/91

Results by Sample

SAMPLE ID B8W

FRACTION 08B TEST CODE SW8240 NAME HSL VOA (SW846 8240)
 Date & Time Collected 01/09/91 17:05:00 Category

ANALYST	PAP	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg	VERIFIED	JHM
Chloromethane			RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT	
Bromomethane			BDL	10	1,2-Dichloropropane	BDL	5.0	
Vinyl Chloride			BDL	10	cis-1,3-Dichloropropene	BDL	5.0	
Chloroethane			BDL	10	Trichloroethene	BDL	5.0	
Methylene Chloride			BDL	10	Dibromochloromethane	BDL	5.0	
Acetone			4 J	5.0	1,1,2-Trichloroethane	BDL	5.0	
Carbon Disulfide			24 B	10	Benzene	BDL	5.0	
1,1-Dichloroethene			BDL	5.0	trans-1,3-Dichloropropene	BDL	5.0	
1,1-Dichloroethane			BDL	5.0	Bromoform	BDL	5.0	
1,2-Dichloroethene total			BDL	5.0	4-Methyl-1-2-Pentanone	BDL	5.0	
Chloroform			BDL	5.0	2-Hexanone	BDL	5.0	
1,2-Dichloroethane			BDL	5.0	Tetrachloroethene	BDL	5.0	
2-Butanone			BDL	10	1,1,2,2-Tetrachloroethane	BDL	5.0	
1,1,1-Trichloroethane			BDL	5.0	Toluene	BDL	5.0	
Carbon Tetrachloride			BDL	5.0	Chlorobenzene	BDL	5.0	
Vinyl Acetate			BDL	10	Ethylbenzene	BDL	5.0	
Bromodichloromethane			BDL	5.0	Styrene	BDL	5.0	
					Xylene total	BDL	5.0	

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

J = estimate below the required det limit.

B = compound detected in method blank.

D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 9 ug/kg ACETONE.

age
Received: 01/14/91

Results by Sample

SAMPLE ID B9W

FRACTION 12B TEST CODE SW8240 NAME HSL VOA (SW846 8240)
Date & Time Collected 01/09/91 17:30:00 Category

ANALYST	PAP	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT	VERIFIED	JHM
Chloromethane							1,2-Dichloropropane	BDL	5.0		
Bromomethane							cis-1,3-Dichloropropene	BDL	5.0		
Vinyl Chloride							Trichloroethene	BDL	5.0		
Chloroethane							Dibromochloromethane	BDL	5.0		
Methylene Chloride							1,1,2-Trichloroethane	BDL	5.0		
Acetone				4 J	5.0		Benzene	BDL	5.0		
Carbon Disulfide				24 B	10		trans1,3-Dichloropropene	BDL	5.0		
1,1-Dichloroethene				BDL	5.0		Bromoform	BDL	5.0		
1,1,1-Dichloroethane				BDL	5.0		4-Methyl-1,2-Pentanone	BDL	5.0		
1,2-Dichloroethene total				BDL	5.0		2-Hexanone	BDL	10		
Chloroform				BDL	5.0		Tetrachloroethene	BDL	5.0		
1,2-Dichloroethane				BDL	5.0		1,1,2,2-Tetrachloroethane	BDL	5.0		
2-Butanone				BDL	10		Toluene	BDL	5.0		
1,1,1-Trichloroethane				BDL	5.0		Chlorobenzene	BDL	5.0		
Carbon Tetrachloride				BDL	5.0		Ethylbenzene	BDL	5.0		
Vinyl Acetate				BDL	10		Styrene	BDL	5.0		
Bromodichloromethane				BDL	5.0		xylene total	BDL	5.0		

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

J = estimate below the required det limit.

B = compound detected in method blank.

D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 9 ug/kg ACETONE.

Received: 01/14/91

SAMPLE ID B105

FRACTION 14B TEST CODE SW8240 NAME HSL VOA (SW846 8240)
Date & Time Collected 01/09/91 17:55:00 Category

Results by Sample

VERIFIED JHM

ANALYST	PAP	ANALYZED 01/18/91	FACTOR	1	UNITS	ug/kg	COMPOUND	RESULT	DET LIMIT
							1,2-Dichloropropane	BDL	5.0
							cis-1,3-Dichloropropene	BDL	5.0
							Trichloroethene	BDL	5.0
							Dibromochloromethane	BDL	5.0
							1,1,2-Trichloroethane	BDL	5.0
							Benzene	BDL	5.0
							trans1,3-Dichloropropene	BDL	5.0
							Bromoform	BDL	5.0
							1,1-Dichloroethene	BDL	5.0
							1,2-Dichloroethene total	BDL	5.0
							2-Hexanone	BDL	10
							Tetrachloroethene	BDL	5.0
							1,1,2,2-Tetrachloroethane	BDL	5.0
							Toluene	BDL	5.0
							Chlorobenzene	BDL	5.0
							Ethylbenzene	BDL	5.0
							Styrene	BDL	5.0
							Xylene total	BDL	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

J = estimate below the required det limit.

B = compound detected in method blank.

D = indicates a secondary dilution was required.

THE METHOD BLANK CONTAINED 1 ug/kg METHYLENE CHLORIDE.

age _____

Received: 01/14/91

No. _____ rde _____ 91- _____ 065

ENVIRONMENTAL TEC. ENG., INC.

02/08/91 11:09

DEFINITIONS AND EXPLANATIONS:

1. THE " X " INDICATES A MATRIX INTERFERENCE WHICH MAY REQUIRE A DILUTION WHICH MAY REQUIRE A DILUTION OR WHICH PREVENTS THE REPORTING OF A RESULT. DETECTION LIMITS HAVE BEEN ADJUSTED WHERE APPLICABLE.

ATTACHMENT B
LETTERS TO EPA-REGION VI

Environmental Technology Engineering, Inc.

January 17, 1991

Raphael Casanova
USEPA - Region VI
1445 Ross Ave., Suite 1200
Dallas, Texas 75202-2733

Re: R & D, Inc.
Trial Burn: Soil Sampling Program

Dear Mr. Casanova:

I am writing to bring you up to date on the status of the soil sampling program currently being conducted at the referenced facility. I am also proposing a sampling scenario for conducting the volatile organic analysis for the remaining samples collected from the facility.

Samples were collected from the facility on January 9, 1991 in accordance with the approved soil sampling plan and shipped overnight to the laboratory. As outlined in the plan, five (5) samples from alternate burner locations were screened for Appendix VII/Appendix IX organics. These analysis yielded the following results:

<u>Sample ID#</u>	<u>Analytical Results</u>
31N	None Detected
33N	None Detected
B5N	Trichlorofluoromethane - 43 µg/kg (1st run)* Acetone - 71 µg/kg (2nd run)
37N	None Detected
89N	Acetone - 24 µg/kg (1st run)** Acetone - 71 µg/kg (2nd run)**

* Not confirmed in the 2nd run.

** Possible laboratory cross contaminant.

Based on these results a screening list was to be developed to be used in analyzing the remaining samples. However, as can be seen, a sufficient target list can not be developed.

Based on these findings, it is proposed that ten (10) additional samples, one randomly selected sample from each of the 10 burner pots, be analyzed for the volatile organic parameters identified on the attached sheet which was originated from the Hazardous Substance List. If volatile organics are detected during

Raphael Casanova
January 17, 1991
Page 2

this phase of analytical work, then the remaining samples will be analyzed for these parameters. If volatile organics are not detected, then no additional analytical work will be performed.

Due to the short holding times allotted for these types of samples, we request that you review the above proposal and advise us as soon as possible of its acceptability.

Respectively,



Michael J. Young
Engineer

cc: Lin Longshore, Laidlaw
Richard Crain, R & D

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO. _____

Name: _____

Contract: _____

Code: _____ Case No.: _____

SAS No.: _____ SDG No.: _____

Matrix: (soil/water) _____

Lab Sample ID: _____

Conc: wt/vol: _____ (g/mL) _____

Lab File ID: _____

Level: (low/med) _____

Date Received: _____

Structure: not dec. _____

Date Analyzed: _____

Unit: (pack/cap) _____

Dilution Factor: _____

CONCENTRATION UNITS:

(ug/L or ug/Kg) _____

Q

CAS NO.	COMPOUND					
74-87-3	Chloromethane					
74-83-9	Bromomethane					
75-01-4	Vinyl Chloride					
75-00-3	Chloroethane					
75-09-2	Methylene Chloride					
7-64-1	Acetone					
5-15-0	Carbon Disulfide					
75-35-4	1,1-Dichloroethane					
75-34-3	1,1-Dichloroethane					
540-59-0	1,2-Dichloroethane (total)					
67-66-3	Chloroform					
107-06-2	1,2-Dichloroethane					
78-93-3	2-Butanone					
71-55-6	1,1,1-Trichloroethane					
56-23-5	Carbon Tetrachloride					
108-05-4	Vinyl Acetate					
75-27-4	Bromodichloromethane					
78-87-5	1,2-Dichloropropane					
10061-01-5	cis-1,3-Dichloropropene					
79-01-6	Trichloroethane					
124-48-1	Dibromochloromethane					
79-00-5	1,1,2-Trichloroethane					
71-43-2	Benzene					
10061-02-6	trans-1,3-Dichloropropene					
75-25-2	Bromoform					
108-10-1	4-Methyl-2-Pentanone					
591-78-6	2-Hexanone					
127-18-4	Tetrachloroethene					
79-34-5	1,1,2,2-Tetrachloroethane					
108-88-3	Toluene					
108-90-7	Chlorobenzene					
100-41-4	Ethylbenzene					
100-42-5	Styrene					
630-20-7	Xylene (total)					

TRICHLOROFLUORODIMETHANE IS NOT ON LIST

FIGURES

APPENDIX Z

SOIL MONITORING PLAN

SOIL MONITORING PLAN

LAIDLAW ENVIRONMENTAL SERVICES (THERMAL TREATMENT), INC.
(FORMERLY R & D FABRICATING AND MANUFACTURING, INC.)

COLFAX, LOUISIANA

LAD981055791

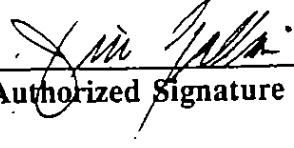
(Revised) July 1993

Prepared by:

ViroGroup, Inc. - ETE Division
Greer, South Carolina
(803) 879-3900

STATEMENT OF CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."


Authorized Signature

JIM GALLION

07/16/93

Date

FACILITY MANAGER, LAIDLAW ENVIRONMENTAL SERVICES (THERMAL TREATMENT), INC.
Title

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EXHIBIT I - WIND ROSE

FIGURE I - SOIL SAMPLING LOCATIONS

APPENDIX A - USATHAMA METHOD FOR ANALYZING TEN EXPLOSIVES BY
HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

APPENDIX B - SITE HEALTH AND SAFETY PLAN

1.0 INTRODUCTION

On March 31, 1993 the Environmental Protection Agency (EPA) issued a RCRA Subpart X and HSWA Permit to R & D Fabricating and Manufacturing, Inc. for the operation of thermal treatment units. The treatment permit was issued subsequent to issuance of a storage permit by the Louisiana Department of Environmental Quality (LDEQ) regulating onsite storage of reactive waste. The full RCRA permit was developed under a joint permitting agreement between the EPA and the LDEQ.

Attachment 15 of the permit contains a Soil Monitoring Plan which addresses how R & D will monitor surface soil in the vicinity of the burner units. Since the permit was drafted, the location of the burn units has been changed slightly to take advantage of better topographic conditions and to better centralize the burn units within the property boundary. In addition, Permit Condition IV.C.7.a) requires that the current monitoring plan be modified to incorporate additional information found in Permit Conditions IV.T.2.(f)-(j) and IV.T.3.(f)-(j).

This revised monitoring plan addresses the additional information requirements and updates the existing plan to reflect actual conditions. The data generated from implementation of this plan can be used to supplement the ongoing environmental assessment over the initial operating period of the facility. This plan is intended to monitor the proposed burn area and will not address the existing burn area, which will be evaluated during closure.

In July 1993, R & D was acquired by Laidlaw Environmental Services (Thermal Treatment), Inc. The new company name is noted on the certification and title page, however; R & D Fabricating and Manufacturing, Inc. is used throughout this document to preserve continuity with the previously submitted Soil Monitoring Plan.

2.0 SAMPLING PROTOCOL

The sampling protocol has been developed to address possible contamination down-wind from the proposed open burning area as a result of particulate fallout. Analytical parameters include metals and organic compounds which may be present in the waste. The ongoing environmental assessment will address this situation through air quality modeling, thus providing an early indication of any potential problems. This sampling protocol is based upon waste constituent data, information already obtained through the trial burn process, and Agency concerns over deposition of heavy metals.

2.1 Constituents of Concern

The Final Technical Support Document for the R & D Thermal Treatment System (ENSR 1991) contains a thorough description of the trial burn and soil sampling results associated with operation of the existing thermal treatment units. Soil samples, including background samples, were collected around the perimeter of the existing burners and were analyzed for extractable explosives as well as Appendix VIII organics and metals. Results showed low levels of HMX and RDX. Also, above background concentrations of eight (8) metals were detected and these metals are considered to be the constituents of greatest concern.

Based upon these results and the constituents in the waste streams handled at the facility, soil samples will be analyzed for the following constituents utilizing the listed method or other approved method:

CONSTITUENT	METHOD
Volatile Organic Compounds	SW-846, 8240
Extractable Explosives (10)	USATHAMA (See App. A)
<u>Total Metals</u>	<u>SW-846 Methods</u>
Arsenic	6010, 7060, 7061
Barium	6010, 7080, 7081

Cadmium	6010, 7130, 7131
Chromium	6010, 7190, 7191
Lead	6010, 7420, 7421
Mercury	7470, 7471
Selenium	6010, 7740, 7741
Silver	6010, 7760, 7761

2.2 Sample Locations and Collection Frequency

The optimum locations for the sampling areas were determined from surface wind direction data compiled at England Air Force Base in Alexandria, Louisiana, a location approximately 15 miles southeast of the R & D facility. Exhibit I contains a wind rose generated from the wind data that was collected from January 1975 through January 1984. The predominate wind directions are from the north during the winter months and south during the summer. The southerly winds predominate and, therefore, emphasis was placed on sample locations to the north of the burner pad.

Figure I shows a total of 12 sample locations which will be used in the soil monitoring plan. Locations 1, 2 and 3 are background samples located in the extreme western portion of the property at 100 foot intervals. The minimal frequency of occurrence of winds from the east-northeast and the distance from the burn area makes this an ideal location for background samples. Locations 4, 5 and 6 are located south of the burn area and are approximately 1000 feet apart. Six sample locations (#7 - #12) have been placed north of the pad in a grid pattern approximately 600 feet apart. These locations will provide good coverage for monitoring of soil in the directions of prevailing winds with regard to the burn area.

Prior to operation of the proposed units, R & D will collect surface samples from all even numbered sample locations noted on Figure I. These samples will be analyzed for the constituents noted in Section 2.1 and the data will be utilized in the development of a background data set for each constituent.

CALMS: 29.7%

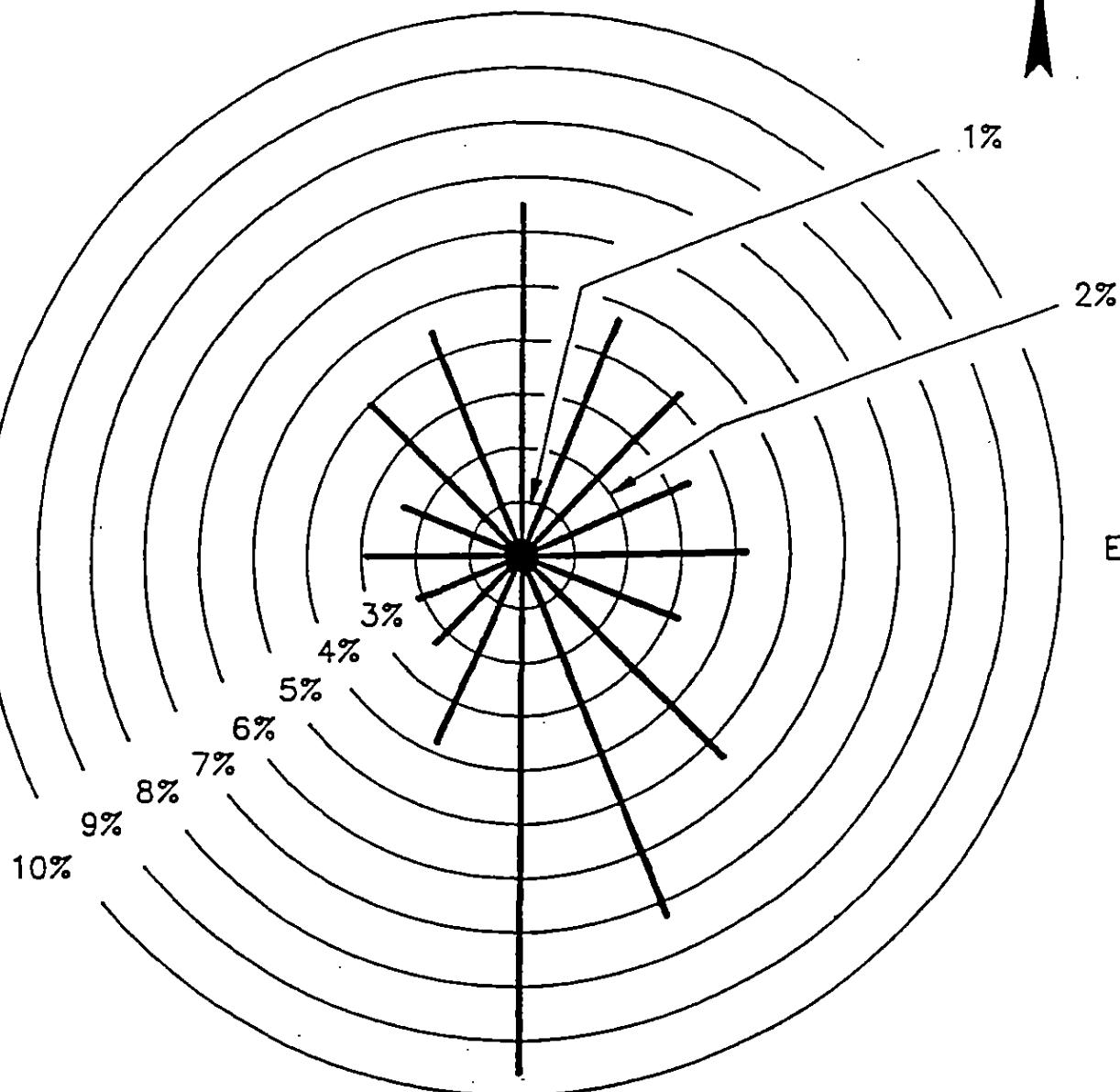


NORTH

WEST

EAST

SOUTH



SOURCE: GLOBAL CLIMATOLOGY BRANCH,
USAFETAC, AIR WEATHER SERVICE/MAC
ENGLAND AIR FORCE BASE
PERIOD: JAN '75 - JAN '84

PERCENTAGE FREQUENCY
OF WIND DIRECTION



Environmental Technology Engineering, Inc.

SCALE AS SHOWN
DRAWN BY GAH
CHECKED BY RJH
DATE 12-15-89

WIND ROSE

EXHIBIT I
PROJECT NO.

After one (1) year of operation of the proposed burner units, soil samples will be collected from all locations and analyzed for the constituents outlined in Section 2.1. Background data from samples 1, 2 and 3 will be combined with the previous data in order to create a complete background data set for each constituent. Data will be analyzed as discussed in Section 4.1 in order to determine if there is a statistically significant difference between background and burn area concentrations of contaminants. If analytical results indicate that a significant difference exists, the Louisiana Department of Environmental Quality (LDEQ) and the Environmental Protection Agency (EPA) will be notified. A plan to address these results will be developed at that time. If no significant increase is noted, the sampling frequency will be extended to two (2) years.

Surface soil samples will be collected directly from the surface sediments using decontaminated stainless steel spoons or a gloved hand to place the sample into the sample container. Sampling personnel shall wear a separate pair of disposable latex gloves for each sample collected. Sample containers will be prepared by the receiving laboratory and will be used as received from them.

3.0 DATA COLLECTION QUALITY ASSURANCE

For all measurement parameters which have analytical QA objectives listed in the most current EPA or USATHAMA Method, those objectives will be used. Where alternative methods may be used by the contract laboratory, those methods and the QA objectives must meet or exceed standards contained in the EPA or USATHAMA method specified in Section 2.1. Systematic checks utilized by the laboratory will ensure data reliability.

The following information defines quality assurance activities in regard to the following:

- ▶ Strategy - Data Usage and Accuracy
- ▶ Sampling and Field Measurements
- ▶ Sample Analysis

3.1 Quality Assurance Strategy

The data collected from soil sampling and analyses will be used to determine if the thermal treatment units are impacting surface soil within the facility property boundary. If it is determined that surface soil is being impacted, measures can be taken to alleviate or minimize this impact.

The background and burn area analytical results will be analyzed statistically as discussed in Section 4.1. Analytical results for metals will be reported in ppm and for organics, ppb. These levels of detection will allow evaluation of data to determine if a significant difference exists between the background and burn area means.

3.1.1 Data Precision and Accuracy

The terms used in this section which characterize data measurement reliability are defined below:

Accuracy - the degree of agreement of a measurement (or an average of measurements of the same thing) X with an accepted reference or true value, $100 \frac{(X-T)}{T}$, and sometimes expressed as the ratio X/T. Accuracy is a measure of the bias in a system.

Precision - a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions."

Completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.

Representativeness - expresses the degree to which data accurately and precisely represent

a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Comparability - expresses the confidence with which one data set can be compared to another.

The precision, or degree of agreement between measurements, is determined by the standard deviation of a single measurement from the mean of the data set. Duplicates of the same sample will be analyzed by the laboratory as a routine precision check. In addition, one duplicate sample per sampling event, selected at random, will be analyzed as a check on sampling and analytical technique.

The accuracy of a sample measurement is reported as percent spike recovery which represents the percentage recovery of a known quantity of compound which is added to the original sample and subsequently analyzed. The methods used in sample analyses will contain quality control audit standards, including sample spiking, to be implemented to ensure data reliability.

3.1.2 Quality Assurance Reports

The contract laboratory will prepare quality assurance documentation for all samples analyzed for each sampling event and will make this documentation available to R & D upon request. The level of detail will be sufficient to document all quality assurance activities specified by the method and shall include but not be limited to:

- Periodic assessment of measurement data accuracy, precision, and completeness;
- Results of performance audits;
- Results of systems audits; and,
- Significant quality assurance problems and resolutions.

A summary of this documentation will be supplied to R & D to be maintained in the data record. Summary information shall include, but not be limited to, percent spike recoveries and the analytical results for duplicate samples.

3.2 Sampling and Field Measurements

Sections 2.0 and 4.0 discuss sample locations, frequency and statistical analysis to be conducted, including rationale for sample locations. The constituents of concern, analytical methods and measures to prevent cross contamination are also addressed. Additional procedures regarding handling of samples are discussed below.

All sample bottle preparation, sample preservation, and maximum holding times shall conform to the procedures described in the analytical method. Sample containers will be prepared by the contract laboratory and will be used as received. The contract laboratory will be responsible for disposing of all samples in accordance with Local, State and Federal regulations.

Sample custody will be documented and maintained for all phases of sampling operations carried out at the facility. The following sections discuss both field and laboratory procedures which will be carried out to ensure the integrity of the sampling effort.

3.2.1 Sample Identification

All samples will be tagged with an identification label which shall be attached directly to the container. At a minimum, the following information will be placed on the label with a waterproof pen.

- Name of Sampling Organization
- Sample Identification Number
- Date

- Time
- Sample Type (i.e., grab, composite)
- Sampling Personnel
- Matrix (May be described by the sample ID #)
- Special Instructions or Precautions

As each sample is collected, a record will be made in the field notebook which further identifies the sample. All samples will be placed in containers and taken to a central staging area where they will be checked and recorded on a chain-of-custody form as described in the following section.

3.2.2 Chain-of Custody Procedures

Chain-of-custody procedures provide documentation of the handling of each sample from the time it is collected until it is destroyed. To maintain a record of sample collection, transfer between personnel, shipment, and receipt and handling by the laboratory, a "Chain-of-Custody Record" will be included with each sample shipment. This document will record pertinent information about each sample included in that shipment. Each time the samples are transferred to another custodian, signatures of the person relinquishing the sample and receiving the sample, as well as the time and date, will document the transfer.

Chain-of-Custody records will have each sample identified with the station number, date and time of collection, matrix, number of containers per station, and analytical constituents. Field forms will include copies so that one copy may be retained while the original and at least one copy are shipped with the samples. The facility manager will retain a copy of the Chain-of-Custody record and keep it in the data record for inspection. If samples are split to different labs, a copy will go to each lab. If additional sheets are required, the person relinquishing the samples is responsible for filling out additional copies, or making reproductions.

The Chain-of-Custody Record will be placed in a protective cover and placed inside the shipping container. All samples will be shipped by the most expedient method to the specified laboratory. Samples will be packed so that no breakage occurs and the shipping container sealed with evidence tape so that any sign of tampering is easily visible.

3.3 Sample Analysis

Chain-of-custody, sample preparation, holding times and analytical procedures have been addressed previously. Additional information regarding sample analysis is provided below.

3.3.1 Instrument Calibration

Each analytical instrument will be calibrated in a manner consistent with EPA calibration protocols and/or the contract laboratory's standard practice. Calibration documentation will be documented in a notebook maintained by the laboratory.

3.3.2 Data Reduction, Validation and Reporting

Data transfer and reduction are essential functions in summarizing information to support conclusions. It is essential that these processes are performed accurately and, in the case of data reduction, accepted statistical techniques are used.

At a minimum, example calculations must be included with the summarized data to facilitate review. The entry of input data and calculations should be checked and the signature or initials of the data technician and reviewer(s) should accompany all data transfers with and without reduction.

Data input and output sheets will be used by the contract laboratory in order to keep track of data. These forms will record all information pertinent to the analytical procedure such as standard curves, QC data, and final results.

For routine analyses, sample response data information will be used to calculate the following as applicable:

1. Quadratic regression line for standards,
2. Coefficient of variation for replicates,
3. Spiked recoveries,
4. Reference sample concentrations, and
5. Sample concentrations.

QC criteria for acceptance will be derived from EPA or the contract laboratory's QC program. The QC criteria will be stored in a data management file for easy retrieval.

If the samples in a sample lot do not pass all the QC checks then the results reported in all samples processed in the same sample set must be considered as suspect and the analyses may need to be repeated. The Laboratory QA Officer will be notified and the necessary corrective action implemented.

The completed batch forms will be stored in files arranged for easy retrieval. Strip charts, copies of parameter notebooks, and QC charts will be stored for each constituent in a project notebook.

The contract laboratory manager will validate a portion of all preliminary data by field group. Example tasks which may be included in the validation review are listed in the following checklist:

1. Were holding times met for each sample?
2. Were samples analyzed using the methods specified in the QA plan?

3. Was a blank run for each batch and properly subtracted from sample?
4. Were the required number of standards and spiked samples analyzed with each batch?
5. Was the correlation coefficient of the calibration curve > 0.995?
6. Were spike recoveries within the acceptance criteria stated in the QA Plan?
7. Randomly select one value/batch and trace back through the calculations to the raw data.
Do the numbers agree?

3.3.3 Internal Quality Control Checks

The laboratory contracted by R & D will adhere to a strict internal quality control program to assure data quality. Internal quality assurance procedures are designed to assure the consistency and continuity of data. Internal quality assurance procedures include:

- Instrument performance checks
- Instrument calibration
- Documentation on the traceability of instrument standards, samples, and data
- Documentation on analytical and quality control methodology
- Documentation on sample preservation and transportation

Standard analytical quality control will include, but is not limited to:

- Duplicate Samples

At selected stations on a random time frame, duplicate grab samples are collected. This provides a check of sampling technique and precision.

- Split Samples

A representative subsample from the collected sample is removed and both are analyzed for the pollutants of interest. The samples may be reanalyzed or analyzed by two different laboratories for a check of the analytical procedures.

- Spiked Samples

Known amounts of a particular constituent are added to an actual sample or to blanks in concentrations at which the accuracy of the test method is satisfactory. This method provides a proficiency check for the accuracy of the analytical procedures.

If the method allows, one to six compounds with characteristics similar to those being analyzed will be added to every sample prior to extraction. The percent recovery of these compounds is indicative of the efficiency of the analysis at recovering the sample compounds. A sample recovery within the range specified by EPA will be deemed sufficient.

Standards will also be run daily to ensure that numerical data reflects the current sensitivity of the instrument. Prior to any GC/MS analyses, the instrument will be tuned to meet particular specifications.

3.4 System Audits

Two types of audit procedures will be used by the contract laboratory to assess and document performance of project staff--system audits and performance audits. These are performed at frequent intervals under the direction of the Laboratory QA Supervisor.

These audits form one of the bases for corrective action requirements and constitute a permanent record of the conformance of measurement systems to QA requirements.

System audits are inspections of training status, records, QC data, calibrations, and conformance to Standard Operating Procedures without the analysis of check samples. System audits will be performed periodically on laboratory and office operations.

The systems audit protocol is summarized as follows:

1. Laboratory Operations--The Laboratory QA Supervisor will check:

- a. Parameter and/or laboratory notebooks;
- b. Instrument logbooks;
- c. Sample log-in, dispensing, and labeling for analysis;
- d. Updating of QC charts of the spikes; and
- e. Final approval of data from each sample lot.

In addition, the Laboratory QA Supervisor will monitor all experiments to assure complete adherence to approved analytical methods.

2. Final Reports--The Laboratory QA Supervisor will review all final reports and deliverables.

Performance test sample programs administered by various government agencies are also used as a basis for the Laboratory QA Supervisor's performance audit.

4.0 DATA MANAGEMENT

R & D will implement these data management procedures in order to document and track analytical data. These procedures address the data record, the data presentation format, and project file requirements.

4.1 Data Record and Presentation

A data record will be maintained at the facility which contains chain of custody records, analytical results received from the outside laboratory, a statistical evaluation of the data, and a summary presentation of the data in tabular form. This information will be maintained as a distinct unit for each sampling event.

Data received from the laboratory will be required to contain the following information:

- A unique sample identification code which includes the sample location.
- Sampling personnel and date of collection.
- The constituent being analyzed and unit of measure.
- Analytical results with the minimum detection limit.

The sample identification code used for soil samples will identify the matrix, specific location, month and the year as shown in the following example for location 9.

S09-0693

S = soil

09 = location 9

06 = June

93 = 1993

Duplicate samples or additional samples at the same location during each sampling event will have an additional designation as shown:

S09-0693A, S09-0693B, etc.

This unique sample identification code will be used to identify a particular sample on all presentations of the data.

All laboratory data will be summarized in tabular form for each sampling event. For each constituent, the sample identification code and concentration at each location will be noted. Any concentrations recorded as less than the detectable limit will have the lower detectable limit numerical value shown (i.e., < 0.1 mg/kg). The lower detectable limit will be established with the laboratory prior to analyzing the first set of samples and will be in accordance with the method used, subject to possible interferences.

For each constituent, the background data set and the burn area data set generated after one year of operation will be analyzed to determine the arithmetic mean and variance for each. The means for each data set will be compared using the Cochran's Approximation to the Behrens-Fisher Students' t-test as outlined in 40 CFR Part 264, Appendix IV. A one-tail test using a standard t-table at a 0.025 level of significance will be used to compute the critical t value. Values recorded as less than the lower detectable limit numerical value will have that value applied in the statistical analysis.

A data summary showing the t-statistics for each constituent will be prepared in tabular form and maintained in the data record. If a constituent concentration is recorded as less than detectable for all sample locations, it will not be included in the statistical analysis summary table.

In the event that the burn area data set mean exceeds the background mean, additional methods of presenting the data may be used to further assess the data sets. These methods may include graphs showing constituent concentrations at a particular sample location over time or isopleth plots.

4.2 Data Files Maintenance

The analytical laboratory contracted by R & D will maintain data generated from soil analyses in a manner consistent with the particular laboratory's standard practice. Hard copies of the analytical data will be provided to R & D to be placed in the data record. As

stated previously, the data record will also contain chain-of-custody forms, a tabular presentation of the raw data, a statistical evaluation and tabular presentation of the statistical analysis.

In addition to the hard copies contained in the data record, the tabular presentations will be maintained on computer disk. These disks will be maintained at the facility with the data record. Also, the data tables and any summaries related to analytical results will be placed in the facility operating record.

5.0 HEALTH AND SAFETY PLAN

R & D maintains a health and safety plan for all contractors working at the site. This plan, which is located in Appendix B, is comprehensive and provides for the protection of all persons at the facility. Persons conducting soil sampling will not be in close proximity to the burn area and will be minimally exposed to storage areas. There will be no direct exposure to waste and exposure to soil will be minimized through Level D protection and the use of disposable latex gloves.

6.0 PROJECT MANAGEMENT

6.1 Key Personnel

The facility manager, Jim Gallion, will have direct responsibility over implementation of the soil monitoring plan. He will be responsible for securing outside contractors, ensuring that provisions of the health and safety plan are followed, and maintaining data files and records. Mr. Gallion has vast experience in the waste disposal industry including employment as a health and safety officer at a Louisiana hazardous waste treatment facility as well as experience in handling explosive and reactive waste.

Richard Crain, facility operations manager, will share responsibility with the facility manager

to ensure that soil monitoring is implemented at the facility in accordance with this plan. Mr. Crain has been the operations manager at R & D since its inception and is thoroughly familiar with the operation. He has significant experience in handling explosive and reactive waste; environmental affairs; and management.

R & D will employ an outside contractor(s) for sampling and analytical work. These contractors will report directly to the facility manager and operations manager.

6.2 Scheduling

An outside contractor(s) for soil sampling and analysis will be secured at least 30 days prior to initial treatment of waste in the proposed burn units. Prior to initiating thermal treatment, the first round of soil samples will be collected as described in Section 2.0. It is anticipated that samples can be collected in a single day and that analysis can be completed within 45 days. An additional 45 days will be used to develop data tables, evaluate the data statistically and prepare a data summary or other necessary documentation.

After one year of operation, the first complete set of samples will be collected with analytical and data analyses completed within an additional 90 days. Raw data tables will be placed in the operating record for the year that samples were collected. Any reports generated as a result of discrepancies in the background and burn area data sets will be submitted to the LDEQ or the EPA within 30 days after data analyses is complete.